



ELECTRON TUBES

Dear Ladies and Gentlemen,

Yes, they're still available! The premium TELTRON and NEVA electron tubes are still in stock in their proven excellent quality and at their traditional low prices.

World-wide there are only a few locations where electron tubes are manufactured. Only specially trained experts with many years of experience have been able to master the technically demanding manufacturing process necessary to guarantee consistently good quality. Our location in Klingenthal / Saxony fulfils these strict requirements. This is where we produce all of our tubes.

On the following pages we have collected for you a choice selection of images and descriptions featuring our extensive tube program. The entire program including all of the corresponding accessories can be found on our website under 3bscientific.com.

We wish you lots of fun reading up on this topic and look forward to continuing to be your supplier of first-class electron tubes at fair prices.

Many friendly greetings,



Dr. Johannes Recht
Business Field Manager Natural Sciences



LEGEND

This indicates which experiments in our physics experiment catalog are relevant to the product. You can also find these experiments on our website under 3bscientific.com. Simply enter the quoted experiment number and you will find the experiment in question.

UEXXXXXX

Don't hesitate to contact us! We look forward to sending you our experiment catalog. On our website you can view the catalog in PDF format in the "Customer service" section under "Request catalog", or simply download or order it. Or you can follow the QR code to the catalog itself.



Download
Experiment Catalog

Experiment topics:

- Linear propagation of electrons in a zero-field space
- Deflection of electron beams in an electrical field
- Deflection of electron beams in a magnetic field
- Magnetic lens
- Phase displacement, superimposition of magnetic fields, Lissajous figures
- Determination of an electron's specific charge
- Determination of an electron's speed



Training Oscilloscope

Electron tube mounted on a terminal base for investigating the design and operation of a cathode ray tube. The electron beam can be deflected by an electric field produced by the deflection plates integrated into the tube, and by a magnetic field from three external coils mounted on a ring. A Wehnelt cylinder is used to focus the beam. The gas filling and the fluorescent screen make it possible to observe the beam in the tube. A continuously adjustable saw-tooth generator can be used to analyse and visualize time dependent processes. The device comes with a socket and printed wiring diagram.

| | |
|------------------------------|-------------------------------|
| Anode voltage: | 200 – 350 V DC |
| Anode current: | max. 1 mA |
| Filament voltage: | 6 – 12 V AC/DC |
| Filament current: | 0.3 A |
| Wehnelt voltage: | 0 – -50 V DC |
| Deflection plate dimensions: | approx. 12x20 mm ² |
| Plate spacing: | approx. 14 mm |

| | |
|----------------------------------|---------------------------------------|
| Electric deflection sensitivity: | 0.2 mm/V |
| Screen diameter: | approx. 100 mm |
| Tube length: | approx. 260 mm |
| Residual gas: | Neon |
| Gas pressure: | 10 ⁻⁴ hPa |
| Sweep frequency: | 10 – 200 Hz, continuously adjustable |
| 3 deflection coils: | 600 turns each, with a centre pick up |
| Weight: | approx. 1.6 kg |

P-1000902

Additionally recommended:

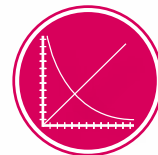
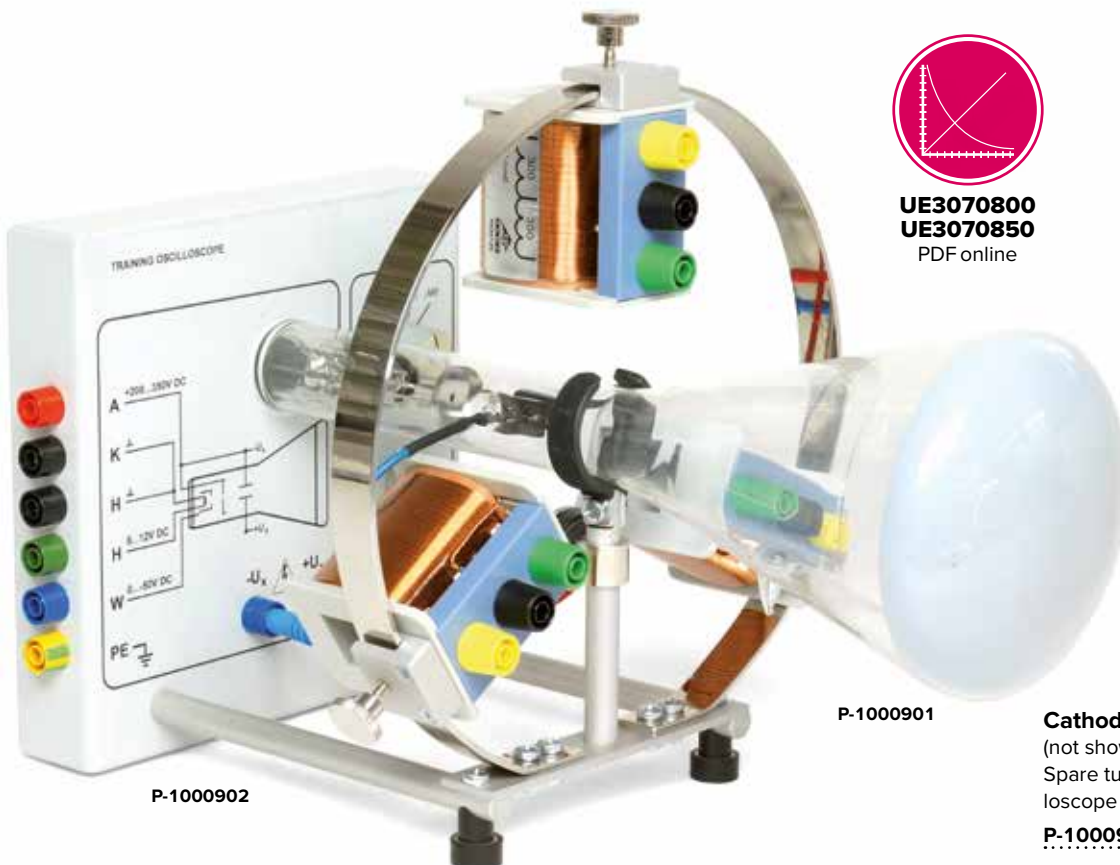
P-1003308 DC Power Supply, 0 – 500 V (230 V, 50/60 Hz)

P-1009957 Function Generator FG100 (230 V, 50/60 Hz)

or

P-1003307 DC Power Supply, 0 – 500 V (115 V, 50/60 Hz)

P-1009956 Function Generator FG100 (115 V, 50/60 Hz)



UE3070800
UE3070850
PDF online

P-1000901

Cathode Ray Tube

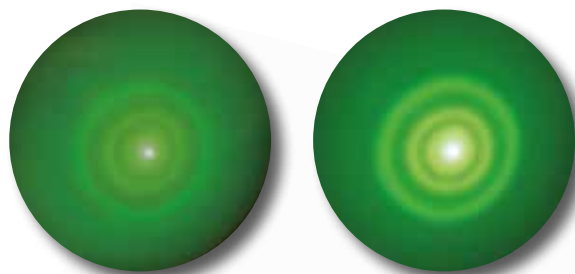
(not shown)

Spare tube for the training oscilloscope (P-1000902).

P-1000901

Experiment topics:

- Thermionic emission of electrons
- Linear propagation of electrons in field free spaces
- Deflection in magnetic and electric fields
- Determination of the polarity of electron charges
- Determination of specific charge e/m
- Inelastic electron collisions
- Luminescence
- Wave and particle nature of electrons



Recording in a darkened room with 3 kV and 4,5 kV.



P-1013885

TELTRON® Electron Tubes D

Known throughout the world, tried and trusted over many years: Electron tubes with thermionic cathodes for experimental investigations of the properties of the free electron.

- Thermionic emission of electrons
- Linear propagation of electrons in field free spaces
- Deflection in magnetic and electric fields
- Determination of the polarity of electron charges
- Determination of specific charge e/m
- Inelastic electron collisions
- Luminescence
- Wave and particle nature of electrons

There is no need to take precautions against ionising radiation, since it is not necessary to use a high voltage of more than 5 kV to operate the tubes.

Electron Diffraction Tube D

Highly evacuated electron tube for demonstrating the wave nature of electrons through the observation of interference caused by passage of electrons through a polycrystalline graphite lattice (Debye-Scherrer diffraction) and rendered visible on a fluorescent screen. Also intended for determining the wavelength as a function of the anode voltage from the radii of the diffraction rings and the lattice plane spacing of graphite, as well as confirming de Broglie's hypothesis.

Filament voltage: 6.3 V AC
 Max. anode voltage: 5000 V
 Anode current: approx. 0.1 mA at 4000 V
 Lattice constant of graphite: $d_{10} = 0.213$ nm, $d_{11} = 0.123$ nm

P-1013885

Additionally required:

P-1008507 Tube Holder D

P-1002847 Set of Leads for Electron Tube Experiments

P-1003310 High Voltage Power Supply, 5 kV (230 V, 50/60 Hz) or

P-1003309 High Voltage Power Supply, 5 kV (115 V, 50/60 Hz)

Additionally recommended:

P-1009960 Three-Pole Protective Adaptor

Note:

When using just one high-voltage power supply, the anode voltage and capacitor voltage cannot be selected independently of one another.

Electron Deflection Tube D

Highly evacuated electron tube with focusing electron gun and fluorescent screen inclined relative to the beam axis, so that the path of the beam can be seen and the effects of electric and magnetic fields can be studied. The electron beam can be deflected electrically in the electric field of the built-in plate capacitor, and magnetically by using the Helmholtz pair of coils D (P-1000644). By adjusting the electric field so that it cancels the magnetic deflection, it is possible to determine the specific charge e/m and the velocity of the electrons.

Filament voltage: 6.3 V AC
 Max. anode voltage: 5000 V
 Anode current: approx. 0.1 mA at 4000 V
 Max. capacitor voltage: 5000 V
 Fluorescent screen: approx. 90x60 mm²
 Glass bulb: approx. 130 mm diam.
 Total length: approx. 260 mm

P-1000651

Additionally required:

P-1008507 Tube Holder D

P-1002847 Set of Leads for Electron Tube Experiments

P-1000644 Helmholtz Pair of Coils D

P-1003310 High Voltage Power Supply, 5 kV (230 V, 50/60 Hz) (2x)

P-1003312 DC-Power Supply 0 – 20 V, 0 – 5 A (230 V, 50/60 Hz) or

P-1003309 High Voltage Power Supply, 5 kV (115 V, 50/60 Hz) (2x)

P-1003311 DC-Power Supply 0 – 20 V, 0 – 5 A (115 V, 50/60 Hz)

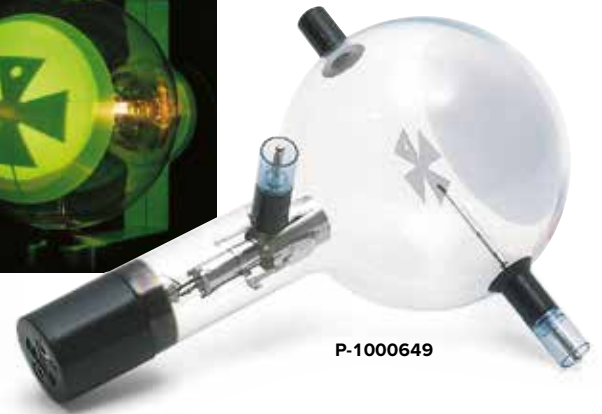
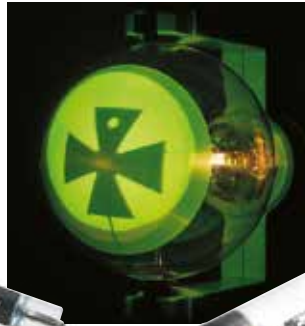
Additionally recommended:

P-1009961 Two-Pole Protective Adaptor





P-1000650



P-1000649

Perrin Tube D

Highly evacuated electron tube with focusing electron gun, fluorescent screen, and Faraday cage positioned on one side. For demonstrating the negative polarity of electrons and estimating the specific electron charge (charge-to-mass ratio) e/m by magnetic deflection into the Faraday cage, which is connected to an electroscope (P-1003048). It is also possible to investigate the deflection of electrons by two magnetic fields at right-angles to each other and to demonstrate the effects, for example by generating Lissajou figures.

Filament voltage: 6.3 V AC
 Max. anode voltage: 5000 V
 Anode current: approx. 0.1 mA at 4000 V
 Beam current: 4 μ A at 4000V
 Glass bulb: approx. 130 mm diam.
 Luminescent screen: 85 mm diam.
 Total length: approx. 250 mm

P-1000650

Additionally required:

- P-1008507 Tube Holder D
- P-1002847 Set of Leads for Electron Tube Experiments
- P-1000644 Helmholtz Pair of Coils D
- P-1003310 High Voltage Power Supply, 5 kV (230 V, 50/60 Hz)
- P-1003312 DC-Power Supply 0 – 20 V, 0 – 5 A (230 V, 50/60 Hz) or
- P-1003309 High Voltage Power Supply, 5 kV (115 V, 50/60 Hz)
- P-1003311 DC-Power Supply 0 – 20 V, 0 – 5 A (115 V, 50/60 Hz)

Additionally recommended:

- P-1003048 Electroscope
- P-1000645 Auxiliary Coil
- P-1009961 Two-Pole Protective Adaptor

Luminescence Tube D

Highly evacuated electron tube with divergent electron gun and three fluorescent strips in red, green and blue. For demonstrating stimulated light emission during and after electron bombardment.

Filament voltage: 6.3 V AC
 Max. anode voltage: 5000 V
 Anode current: approx. 0.1 mA at 4000 V
 Glass bulb: approx. 130 mm diam.
 Total length: approx. 260 mm

P-1000648

Additionally required:

- P-1008507 Tube Holder D
- P-1002847 Set of Leads for Electron Tube Experiments
- P-1003310 High Voltage Power Supply, 5 kV (230 V, 50/60 Hz) or
- P-1003309 High Voltage Power Supply, 5 kV (115 V, 50/60 Hz)

Additionally recommended:

- P-1009961 Two-Pole Protective Adaptor

Maltese-Cross Tube D

Highly evacuated electron tube with divergent electron gun, fluorescent screen and Maltese cross. For demonstrating the straight line propagation of electrons in the absence of any electric or magnetic field by projecting the shadow of a Maltese cross onto the fluorescent screen and for introducing students to electron optics.

Filament voltage: 6.3 V AC
 Max. anode voltage: 5000 V
 Anode current: approx. 0.1 mA at 4000 V
 Glass bulb: approx. 130 mm diam.
 Luminescent screen: 85 mm diam.
 Total length: approx. 260 mm

P-1000649

Additionally required:

- P-1008507 Tube Holder D
- P-1002847 Set of Leads for Electron Tube Experiments
- P-1003310 High Voltage Power Supply, 5 kV (230 V, 50/60 Hz) or
- P-1003309 High Voltage Power Supply, 5 kV (115 V, 50/60 Hz)

Additionally recommended:

- P-1009961 Two-Pole Protective Adaptor
- P-1000644 Helmholtz Pair of Coils D
- P-1003312 DC-Power Supply 0 – 20 V, 0 – 5 A (230 V, 50/60 Hz) or
- P-1003311 DC-Power Supply 0 – 20 V, 0 – 5 A (115 V, 50/60 Hz)



P-1000648



Triode D

Highly evacuated electron tube with thermionic cathode, control grid and anode for quantitative investigation of controllable high vacuum tubes, plotting the characteristics of a triode, demonstrating the negative polarity of the electron charge, studying the practical applications of a triode as an amplifier and generating undamped oscillations in LC circuits.

Max. heater voltage: 7.5 V AC/DC
 Max. anode voltage: 500 V
 Anode current: approx. 2 mA at 200 V anode voltage
 Glass bulb: approx. 130 mm diam.
 Total length: approx. 260 mm

P-1000647

Additionally required:

- P-1008507 Tube Holder D**
- P-1002847 Set of Leads for Electron Tube Experiments**
- P-1013527 Analogue Multimeter ESCOLA 100**
- P-1003308 DC Power Supply, 0 – 500 V (230 V, 50/60 Hz)**
- or
- P-1003307 DC Power Supply, 0 – 500 V (115 V, 50/60 Hz)**

Additionally recommended:

- P-1009961 Two-Pole Protective Adaptor**

Diode D

Highly evacuated electron tube with thermionic cathode and anode for investigating the thermoelectric effect (Edison effect) and measuring the emission current as a function of the heating power applied to the cathode. Also for plotting diode characteristics and for demonstrating the rectifying effect of a diode.

Max. heater voltage: 7.5 V AC/DC
 Max. anode voltage: 500 V
 Anode current: approx. 2 mA at 200 V Anode voltage
 Glass bulb: approx. 130 mm diam.
 Total length: approx. 260 mm

P-1000646

Gas Triode D

Electron tube filled with low pressure helium gas, with thermionic cathode, control grid, and anode for quantitative investigations of the typical properties of a gas-filled triode, recording the $I_A - U_A$ characteristics of a thyatron, observing independent and dependent discharges as well as discontinuous energy release of He atoms during inelastic collisions with free electrons.

Max. heater voltage: 7.5 V AC/DC
 Max. anode voltage: 500 V
 Anode current: approx. 10 mA at 200 V anode voltage
 Glass bulb: approx. 130 mm diam.
 Total length: approx. 260 mm

P-1000653

Additionally required:

- P-1008507 Tube Holder D**
- P-1002847 Set of Leads for Electron Tube Experiments**
- P-1013527 Analogue Multimeter ESCOLA 100**
- P-1003308 DC Power Supply, 0 – 500 V (230 V, 50/60 Hz)**
- or
- P-1003307 DC Power Supply, 0 – 500 V (115 V, 50/60 Hz)**

Additionally recommended:

- P-1009961 Two-Pole Protective Adaptor**



Additionally required:

- P-1008507 Tube Holder D**
- P-1002847 Set of Leads for Electron Tube Experiments**
- P-1013527 Analogue Multimeter ESCOLA 100**
- P-1003308 DC Power Supply, 0 – 500 V (230 V, 50/60 Hz)**
- or
- P-1003307 DC Power Supply, 0 – 500 V (115 V, 50/60 Hz)**

Additionally recommended:

- P-1009961 Two-Pole Protective Adaptor**

| | | P-1000646 | P-1000647 | P-1000653 |
|--------------------------------------|---|----------------|-----------------|---------------------|
| | | Diode D | Triode D | Gas Triode D |
| P-1008507 | Tube Holder D | required | required | required |
| P-1002847 | Set of Leads for Electron Tube Experiments | required | required | required |
| P-1003308 or P-1003307 | Power Supply, 500 V DC | required | required | required |
| P-1003310 or P-1003309 | High Voltage Power Supply, 5 kV | – | – | – |
| P-1000644 | Helmholtz Pair of Coils D | – | – | – |
| P-1003312 or P-1003311 | DC-Power Supply 20 V | – | – | – |
| P-1013527 | Analogue Multimeter ESCOLA 100 | required | required | required |
| P-1009961 | Two-Pole Protective Adaptor | recommended | recommended | recommended |
| P-1009960 | Three-Pole Protective Adaptor | – | – | – |
| P-1000645 | Auxiliary Coil | – | – | – |
| P-1003048 | Electroscope | – | – | – |

Dual Beam Tube D

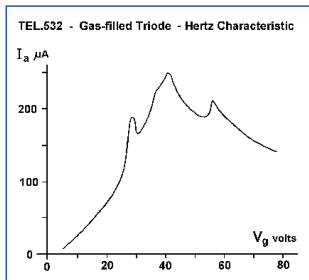
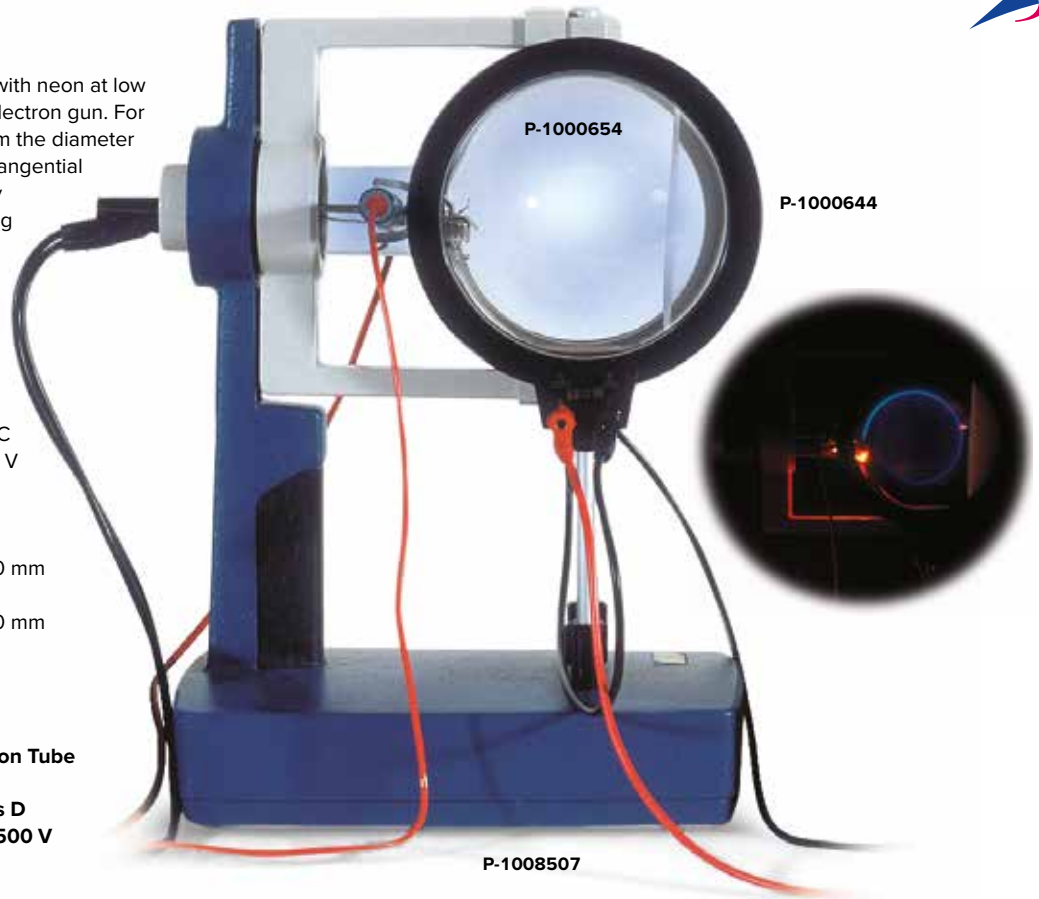
Part evacuated electron tube, filled with neon at low pressure, with tangential and axial electron gun. For determining specific charge e/m from the diameter of the filament beam in the case of tangential bombardment and a perpendicularly aligned magnetic field, and observing spiral paths of electrons in the case of axial bombardment and a co-axial magnetic field. The electron paths are rendered visible in the form of fine luminescent beams through impact excitation of the neon atoms.

- Max. filament voltage: 7.5 V AC/DC
- Anode voltage: approx. 150 V DC
- Max. anode current: < 30 mA
- Max. deflection voltage: 50 V DC
- Glass bulb: approx. 130 mm diam.
- Total length: approx. 260 mm

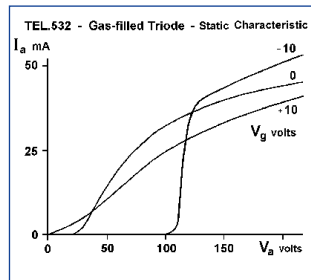
P-1000654

Additionally required:

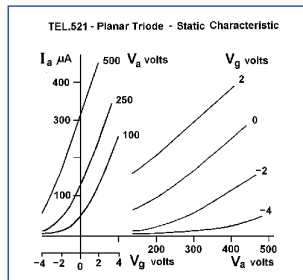
- P-1008507 Tube Holder D**
 - P-1002847 Set of Leads for Electron Tube Experiments**
 - P-1000644 Helmholtz Pair of Coils D**
 - P-1003308 DC Power Supply, 0 – 500 V (230 V, 50/60 Hz)**
- or
- P-1003307 DC Power Supply, 0 – 500 V (115 V, 50/60 Hz)**



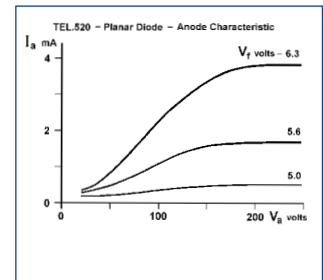
P-1000653: Electron collision excitation in Helium as a function of the acceleration voltage U_A



P-1000653: Anode current I_A as a function of the anode voltage U_A at different grid voltages U_G



P-1000647: Anode current I_A as a function of the grid voltage U_G and as a function of the anode voltage U_A at different grid voltage U_G



P-1000646: Anode current I_A as a function of the anode voltage U_A

| P-1000654 | P-1000648 | P-1000649 | P-1000650 | P-1000651 | P-1013885 |
|-------------------------|----------------------------|-----------------------------|----------------------|-----------------------------------|------------------------------------|
| Dual Beam Tube D | Luminescence Tube D | Maltese Cross Tube D | Perrin Tube D | Electron Deflection Tube D | Electron Diffraction Tube D |
| required | required | required | required | required | required |
| required | required | required | required | required | required |
| required | – | – | – | – | – |
| – | required | required | required | 2x required | required |
| required | – | recommended | required | required | – |
| – | – | recommended | required | required | – |
| – | – | – | – | – | – |
| – | recommended | recommended | recommended | recommended | – |
| – | – | – | – | – | recommended |
| – | – | – | recommended | – | – |
| – | – | – | recommended | – | – |



P-1008507

Tube Holder D

Tube holder made of robust plastic for holding electron tubes of the D series and the optical equivalent (P-1000656). With 360° rotating clamp made of heat-resistant plastic and two holes for fixing the Helmholtz coil pair D (P-1000644).

On rubber feet to prevent slipping.

Dimensions: approx. 230x175x320 mm³

Weight: approx. 1.5 kg

P-1008507

Auxiliary Coil

Extra coil for generating an additional magnetic field in a Perrin tube, for example, to demonstrate the principle of an oscilloscope and for generating Lissajou's figures.

Number of turns: 1000

DC resistance: approx. 7 Ω

Load rating: max. 2 A

Connections: 4 mm jacks

Dimensions: approx. 33 mm x 80 mm diam.

P-1000645

Optical Equivalent to Debye-Scherrer Interference

Aluminium disc with ball bearing mounted optical lattice grating for illustrating the principle of Debye-Scherrer interference using visible light. The rotating lattice grating serves as a model for the polycrystalline graphite lattice in the electron diffraction tube. Includes an aperture and red and green colour filters.

Cross lattice: 20 grid points/mm, 3 mm diam.

Flywheel: 100 mm diam.

Pinhole aperture: 1 mm dia.

Aperture frame: approx. 50x50 mm²

Filter: approx. 80x100 mm²

P-1000656

Additionally recommended:

P-1008507 Tube Holder D

P-1003188 Optical Lamp

P-1000593 Transformer 12 V, 60 VA (230 V, 50/60 Hz)

or

P-1006780 Transformer 12 V, 60 VA (115 V, 50/60 Hz)

P-1003023 Convex Lens, f = 100 mm

P-1000855 Object Holder on Stem

P-1000608 Projection Screen

P-1002835 Tripod Base

P-1001046 Barrel Foot (3x)

Protective Adaptor, 3-Pole

Adaptor for electron diffraction tube D (P-1013885) for connection of the heater voltage via safety experiment leads. Includes internal protective circuitry to protect the heating filament against excess voltage. Dimensions match the three-pole connector for the tube.

P-1009960

Protective Adaptor, 2-Pole

Adaptor for electron tubes D for connection of the heater voltage via safety experiment leads. Includes internal protective circuitry to protect the heating filament against excess voltage. Dimensions match the two-pole connector for the tubes.

P-1009961



P-1000645

P-1000644

Helmholtz Pair of Coils D

Pair of coils for generating a uniform magnetic field perpendicular to the axis of a tube when using the tube holder D (P-1008507).

In plastic sleeve on an insulated stand rod.

Coil diameter: 136 mm

Number of turns: 320 each

Effective resistance: approx. 6.5 Ω each

Load rating: 1.5 A each

Terminals: 4 mm sockets

Rod: approx. 145 mm x 8 mm diam.

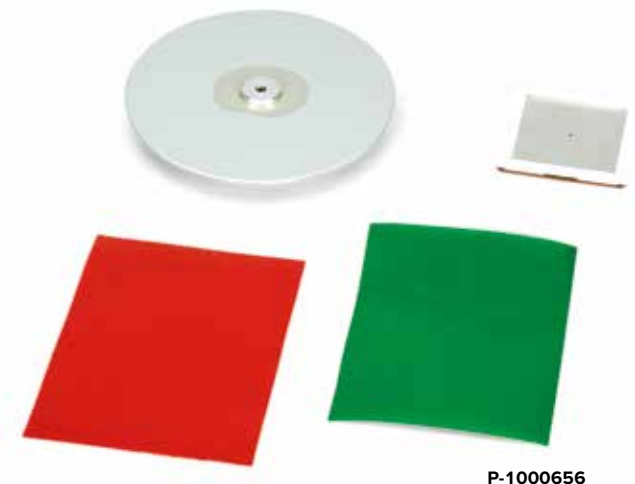
P-1000644

Additionally recommended:

P-1003312 DC-Power Supply 0 – 20 V, 0 – 5 A
(230 V, 50/60 Hz)

or

P-1003311 DC-Power Supply 0 – 20 V, 0 – 5 A
(115 V, 50/60 Hz)



P-1000656

Experiment topics:

- Thermionic emission of electrons
- Linear propagation of electrons in field free spaces
- Deflection in magnetic and electric fields
- Determination of the polarity of electron charges
- Determination of specific charge e/m
- Luminescence
- Excitation spectra of noble gases
- Inelastic electron collisions
- Resolution of primary and secondary quantum numbers of atomic excitation levels
- Wave and particle nature of electrons



P-1000617

Thomson Tube S

Highly evacuated electron tube with focusing electron gun and fluorescent screen inclined relative to the beam axis, so that the path of the beam can be seen and the effects of electric and magnetic fields can be studied. The electron beam can be deflected electrically in the electric field of the built-in plate capacitor, and magnetically by using the Helmholtz coil pair S (P-1000611). By adjusting the electric field so that it cancels the magnetic deflection, it is possible to determine the specific charge e/m and the velocity of the electrons.

| | |
|-------------------------|--------------------------|
| Filament voltage: | 6.3 V AC |
| Max. anode voltage: | 5000 V |
| Anode current: | approx. 0.1 mA at 4000 V |
| Max. Capacitor voltage: | 500 V |
| Glass bulb: | approx. 130 mm diam. |
| Total length: | approx. 250 mm |

P-1000617

Additionally required:

P-1014525 Tube Holder S

P-1002843 Set of 15 Safety Experiment Leads, 75 cm

P-1000611 Helmholtz Pair of Coils S

P-1003310 High Voltage Power Supply, 5 kV (230 V, 50/60 Hz)

P-1003308 Power Supply, 500 V DC (230 V, 50/60 Hz)

or

P-1003309 High Voltage Power Supply, 5 kV (115 V, 50/60 Hz)

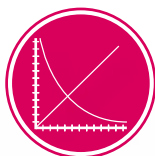
P-1003307 Power Supply, 500 V DC (115 V, 50/60 Hz)

TELTRON® Electron Tubes S

Known throughout the world, tried and trusted over many years: Electron tubes with thermionic cathodes for experimental investigations of the properties of the free electron.

- Thermionic emission of electrons
- Linear propagation of electrons in field free spaces
- Deflection in magnetic and electric fields
- Determination of the polarity of electron charges
- Determination of specific charge e/m
- Luminescence
- Excitation spectra of noble gases
- Inelastic electron collisions
- Resolution of primary and secondary quantum numbers of atomic excitation levels
- Wave and particle nature of electrons

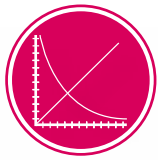
There is no need to take precautions against ionising radiation, since it is not necessary to use a high voltage of more than 5 kV to operate the tubes



UE3070500

PDF online

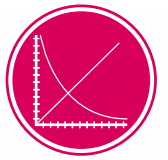




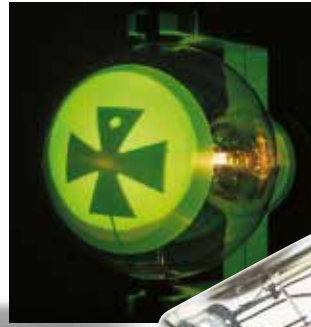
UE3070300
PDF online



P-1000011



UE3070400
PDF online



P-1000616



Maltese Cross Tube S

Highly evacuated electron tube with divergent electron gun, fluorescent screen and Maltese cross. For demonstrating the straight line propagation of electrons in the absence of any electric or magnetic field by projecting the shadow of a Maltese cross onto the fluorescent screen and for introducing students to electron optics.

Filament voltage: 6.3 V AC
Max. anode voltage: 5000 V
Anode current: approx. 0.1 mA at 4000 V
Glass bulb: approx. 130 mm diam.
Luminescent screen: approx. 85 mm diam.
Total length: approx. 250 mm

P-1000011

Additionally required:

- P-1014525 Tube Holder S**
- P-1002843 Set of 15 Safety Patch Cords, 75 cm**
- P-1003310 High Voltage Power Supply, 5 kV (230 V, 50/60 Hz)**
- or
- P-1003309 High Voltage Power Supply, 5 kV (115 V, 50/60 Hz)**

Additionally recommended:

- P-1000611 Helmholtz Pair of Coils S**
- P-1003312 DC-Power Supply 0 – 20 V, 0 – 5 A (230 V, 50/60 Hz)**
- or
- P-1003311 DC-Power Supply 0 – 20 V, 0 – 5 A (115 V, 50/60 Hz)**

Luminescence Tube S

Highly evacuated electron tube with divergent electron gun and three fluorescent strips in red, green and blue. For demonstrating stimulated light emission during and after electron bombardment.

Filament voltage: 6.3 V AC
Max. anode voltage: 5000 V
Anode current: approx. 0.1 mA at 4000 V
Glass bulb: approx. 130 mm diam.
Total length: approx. 250 mm

P-1000615

Additionally required:

- P-1014525 Tube Holder S**
- P-1002843 Set of 15 Safety Patch Cords, 75 cm**
- P-1003310 High Voltage Power Supply, 5 kV (230 V, 50/60 Hz)**
- or
- P-1003309 High Voltage Power Supply, 5 kV (115 V, 50/60 Hz)**

Perrin Tube S

Highly evacuated electron tube with focusing electron gun, fluorescent screen, and Faraday cage positioned on one side. For demonstrating the negative polarity of electrons and estimating the specific electron charge (charge to mass ratio) e/m by magnetic deflection into the Faraday cage, which is connected to an electroscopes (P-1003048). It is also possible to investigate the deflection of electrons by two alternating magnetic fields at right-angles to each other or by parallel electric and magnetic fields and to demonstrate the effects, for example by generating Lissajous figures.

Filament voltage: 6.3 V AC
Max. anode voltage: 5000 V
Anode current: approx. 0.1 mA at 4000 V
Beam current: 4 μ A at 4000V
Glass bulb: approx. 130 mm diam.
Luminescent screen: approx. 85 mm diam.
Total length: approx. 250 mm

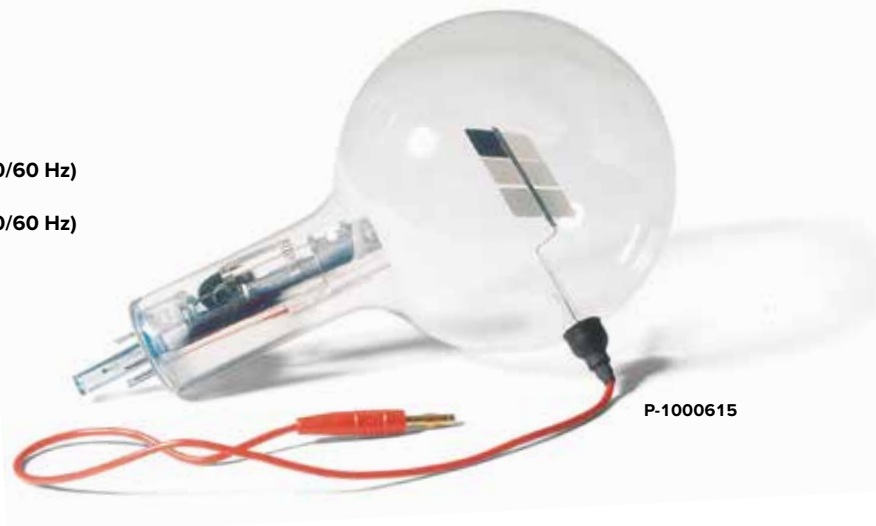
P-1000616

Additionally required:

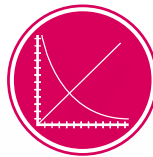
- P-1014525 Tube Holder S**
- P-1002843 Set of 15 Safety Patch Cords, 75 cm**
- P-1000611 Helmholtz Pair of Coils S**
- P-1003310 High Voltage Power Supply, 5 kV (230 V, 50/60 Hz)**
- P-1003312 DC-Power Supply 0 – 20 V, 0 – 5 A (230 V, 50/60 Hz)**
- or
- P-1003309 High Voltage Power Supply, 5 kV (115 V, 50/60 Hz)**
- P-1003311 DC-Power Supply 0 – 20 V, 0 – 5 A (115 V, 50/60 Hz)**

Additionally recommended:

- P-1003048 Electroscopes**
- P-1000645 Auxiliary Coil**



P-1000615

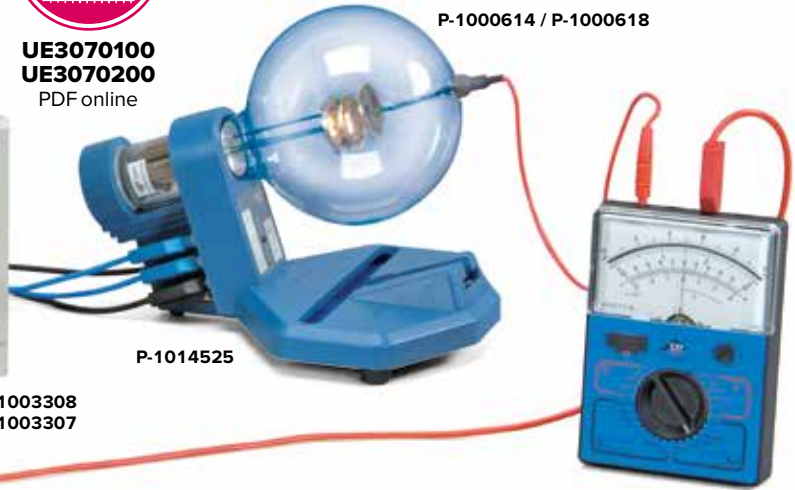


UE3070100
UE3070200
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P-1000614 / P-1000618



P-1003308
P-1003307



P-1014525

Diode S

Highly evacuated electron tube with thermionic cathode and anode for investigating the thermoelectric effect (Edison effect) and measuring the emission current as a function of the heating power applied to the cathode. Also for plotting diode characteristics and for demonstrating the rectifying effect of a diode.

Max. heater voltage: 7.5 V AC/DC

Max. anode voltage: 500 V

Anode current: approx. 2 mA at 200 V Anode voltage

Glass bulb: approx. 130 mm diam.

Total length: approx. 250 mm

P-1000613

Additionally required:

P-1014525 Tube Holder S

P-1002843 Set of 15 Safety Patch Cords, 75 cm

P-1013527 Analogue Multimeter ESCOLA 100

P-1003308 Power Supply, 500 V DC (230 V, 50/60 Hz)

or

P-1003307 Power Supply, 500 V DC (115 V, 50/60 Hz)

Triode S

Highly evacuated electron tube with thermionic cathode, control grid and anode for quantitative investigation of controllable high vacuum tubes, plotting the characteristics of a triode, demonstrating the negative polarity of the electron charge, studying the practical applications of a triode as an amplifier and generating undamped oscillations in LC circuits

Max. heater voltage: 7.5 V AC/DC

Max. anode voltage: 500 V

Anode current: approx. 2 mA at 200 V anode voltage

Glass bulb: approx. 130 mm diam.

Total length: approx. 250 mm

P-1000614

Additionally required:

P-1014525 Tube Holder S

P-1002843 Set of 15 Safety Patch Cords, 75 cm

P-1013527 Analogue Multimeter ESCOLA 100

P-1003308 Power Supply, 500 V DC (230 V, 50/60 Hz)

or

P-1003307 Power Supply, 500 V DC (115 V, 50/60 Hz)

Gas Triode S

Electron tube filled with low pressure helium gas resp. neon gas, with thermionic cathode, control grid, and anode for quantitative investigations of the typical properties of a gas-filled triode, recording the $I_A - U_A$ characteristics of a thyatron, observing independent and dependent discharges as well as discontinuous energy release of He or Ne atoms during inelastic collisions with free electrons.

Max. heater voltage: 7.5 V AC/DC

Max. anode voltage: 500 V

Anode current: approx. 10 mA at 200 V anode voltage

Glass bulb: approx. 130 mm diam.

Total length: approx. 250 mm

Gas Triode S with He Filling

P-1000618

Gas Triode S with Ne Filling

P-1000619

Additionally required:

P-1014525 Tube Holder S

P-1002843 Set of 15 Safety Patch Cords, 75 cm

P-1013527 Analogue Multimeter ESCOLA 100

P-1003308 Power Supply, 500 V DC (230 V, 50/60 Hz)

or

P-1003307 Power Supply, 500 V DC (115 V, 50/60 Hz)

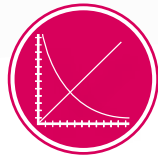


P-1000613

P-1000614 /
P-1000618 /
P-1000619



P-1013889



UE5010500
PDF online

Dual Beam Tube S

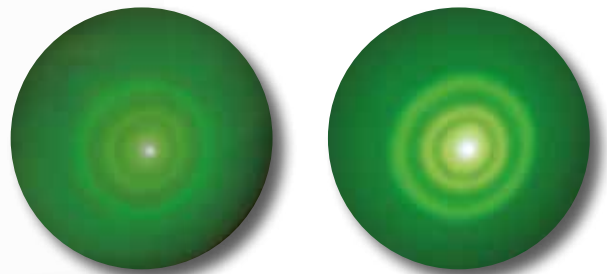
Partly evacuated electron tube, filled with neon at low pressure, with tangential and axial electron gun. For determining specific charge e/m from the diameter of the filament beam in the case of tangential bombardment and a perpendicularly aligned magnetic field, and observing spiral paths of electrons in the case of axial bombardment and a co-axial magnetic field. The electron paths are rendered visible in the form of fine luminescent beams through impact excitation of the neon atoms.

Max. filament voltage: 7.5 V AC/DC
 Anode voltage: approx. 150 V DC
 Max. anode current: < 30 mA
 Max. deflection voltage: 50 V DC
 Glass bulb: approx. 130 mm diam.
 Total length: approx. 250 mm

P-1000622

Additionally required:

- P-1014525 Tube Holder S
- P-1002843 Set of 15 Safety Patch Cords, 75 cm
- P-1000611 Helmholtz Pair of Coils S
- P-1003308 Power Supply, 500 V DC (230 V, 50/60 Hz)
- or
- P-1003307 Power Supply, 500 V DC (115 V, 50/60 Hz)



Recording in a darkened room with 3 kV and 4,5 kV.

Electron Diffraction Tube S

Highly evacuated electron tube for demonstrating the wave nature of electrons through the observation of interference caused by passage of electrons through a polycrystalline graphite lattice (Debye-Scherrer diffraction) and rendered visible on a fluorescent screen. Also intended for determining the wavelength as a function of the anode voltage from the radii of the diffraction rings and the lattice plane spacing of graphite, as well as confirming de Broglie's hypothesis.

Filament voltage: 6.3 V AC
 Max. anode voltage: 5000 V
 Anode current: approx. 0.1 mA at 4000 V
 Lattice constant of graphite: $d_{10} = 0.213$ nm, $d_{11} = 0.123$ nm

P-1013889

Additionally required:

- P-1014525 Tube Holder S
- P-1002843 Set of 15 Safety Experiment Leads, 75 cm
- P-1003310 High Voltage Power Supply, 5 kV (230 V, 50/60 Hz)
- or
- P-1003309 High Voltage Power Supply, 5 kV (115 V, 50/60 Hz)



P-1000622

| | | P-1000613 | P-1000614 | P-1000618 | P-1000619 |
|------------------------|---|-----------|-----------|------------------------------|------------------------------|
| | | Diode S | Triode S | Gas Triode S with He Filling | Gas Triode S with Ne Filling |
| P-1014525 | Tube Holder S | required | required | required | required |
| P-1002843 | Set of 15 Safety Patch Cords, 75 cm | required | required | required | required |
| P-1002839 | Experiment Lead, Safety Plug and Socket | – | – | – | – |
| P-1003308 or P-1003307 | Power Supply, 500 V DC | required | required | required | required |
| P-1003310 or P-1003309 | High Voltage Power Supply, 5 kV | – | – | – | – |
| P-1000611 | Helmholtz Pair of Coils S | – | – | – | – |
| P-1003312 or P-1003311 | DC-Power Supply, 20 V | – | – | – | – |
| P-1013527 | Analogue Multimeter ESCOLA 100 | required | required | required | required |
| P-1000645 | Auxiliary Coil | – | – | – | – |
| P-1003048 | Electroscope | – | – | – | – |

Tube Holder S

Tube holder to support all S series electron tubes for easy and safe operation. The five pin sockets for the tube are concealed inside the tube holder. A cathode protection switch is integrated into the tube holder, to protect the heated cathode from excessive voltage. The base plate has a slot for attaching the Helmholtz pair of coils S (P-1000611).

Terminals : 4 mm safety sockets
 Dimensions: approx. 130x190x250 mm³
 Weight: approx. 570 g

P-1014525



P-1014525

Replacement Circuit Board for Tube Holder S

The quality of the electron beam in electron defraction tube S (P-1013889) is affected by the resistance between sockets C5 (cathode) and F4 (heating filament) on the tube. For optimum results, the resistance needs to be 390 kΩ. Tube holder S (P-1014525) is accordingly designed such that this resistance is present. Older designs feature a much smaller resistance and need to be modified in order to work with the new S-series electron deflection tube (P-1013889).
 Tube holders affected: U18500, U185001, P-1000610

P-4008573



P-4008573

Helmholtz Pair of Coils S

Pair of coils for generating a uniform magnetic field perpendicular to the axis of a tube when using the tube holder S (P-1014525).

Number of turns: 320 each
 Coil diameter: 138 mm each
 Load rating: 1.0 A (Continuous operation) each
 1.5 A (Short-term operation)
 Effective Resistance: approx. 6,5 Ω each
 Terminals: 4 mm safety sockets

P-1000611

Additionally recommended:

P-1003312 DC-Power Supply 0 – 20 V, 0 – 5 A (230 V, 50/60 Hz)
 or
P-1003311 DC-Power Supply 0 – 20 V, 0 – 5 A (115 V, 50/60 Hz)



P-1000611

| P-1000622 | P-1000615 | P-1000011 | P-1000616 | P-1000617 | P-1013889 | P-1000624 |
|------------------|---------------------|----------------------|---------------|----------------|----------------------------|----------------------|
| Dual Beam Tube S | Luminescence Tube S | Maltese Cross Tube S | Perrin Tube S | Thomson Tube S | Electron Defraction Tube S | Gas Discharge Tube S |
| required | required | required | required | required | required | required |
| required | required | required | required | required | required | – |
| – | – | – | – | – | – | 2x required |
| required | – | – | – | required | – | – |
| – | required | required | required | required | required | required |
| required | – | recommended | required | required | – | – |
| – | – | recommended | required | – | – | – |
| – | – | – | – | – | – | – |
| – | – | – | recommended | – | – | – |
| – | – | – | recommended | – | – | – |



P-1000624

Gas Discharge Tube S

Evacuatable glass tube with fluorescent screens at both ends for observation of electrical discharges in gases under reduced pressure as well as for investigation of cathode beams and canal rays, which appear at low pressure outside the discharge path. Demountable design, installation in tube holder (P-1014525). Includes a needle ventilation valve and vacuum hoses.

Length: approx. 280 mm
 Polarization voltage: ≤ 5 kV
 Discharge current: approx. 1.2 mA
 Connections: 4 mm contact pins

P-1000624

Additionally required:

- P-1014525 Tube Holder S
- P-1002839 Experiment Lead, Safety Plug and Socket (2x)
- P-1003317 Rotary-Vane Vacuum Pump, Two-Stage
- P-1003310 High Voltage Power Supply, 5 kV (230 V, 50/60 Hz)
- or
- P-1003309 High Voltage Power Supply, 5 kV (115 V, 50/60 Hz)

Gas Discharge Tube

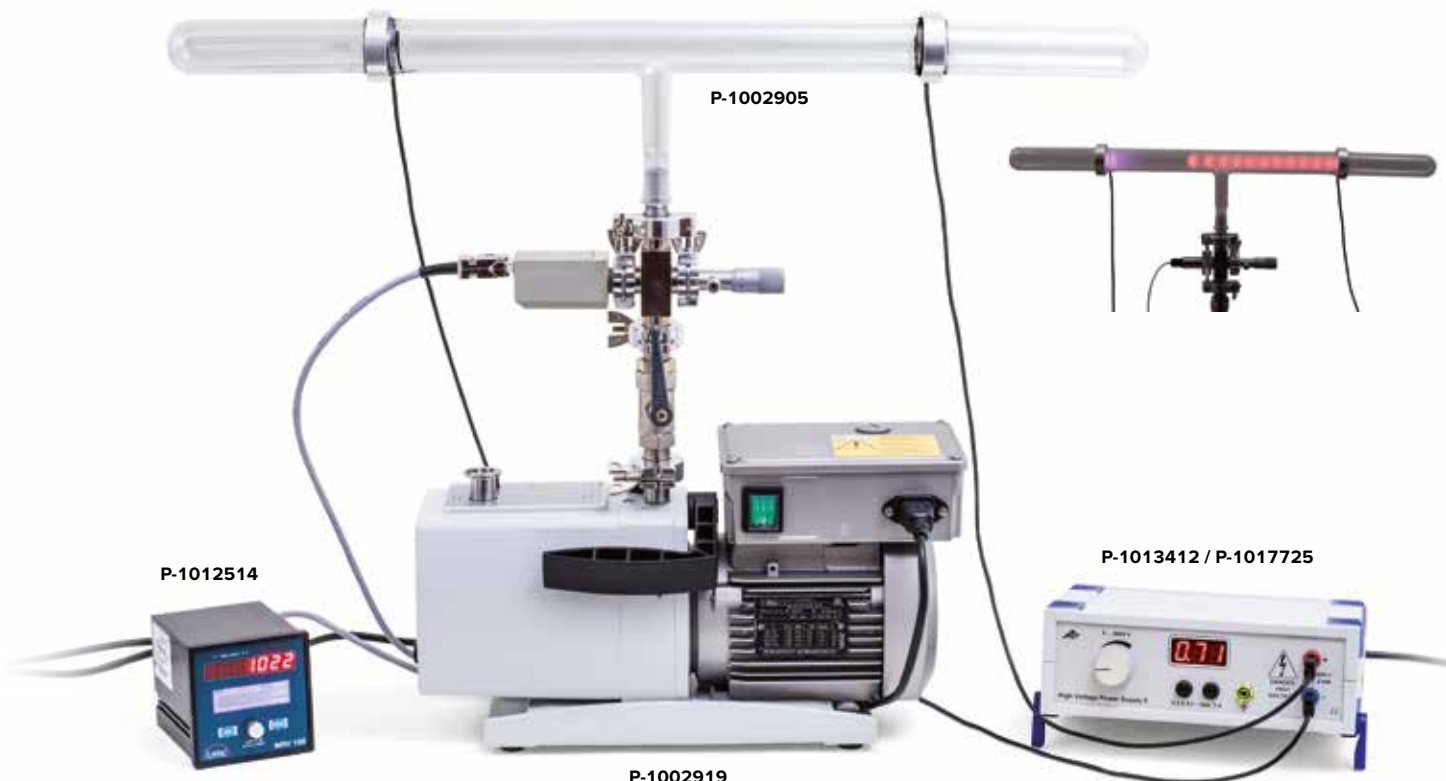
Evacuatable glass tube for observation of luminous effects of electrical discharges in gases under reduced pressure. Glass tube with graded seal, disc shaped, perforated electrodes and 4 mm jacks for connecting the voltage supply.

Material: glass
 Dimensions: approx. 700 mm x 40 mm diam.
 Vacuum connection: graded seal NS 19/26

P-1002905

Additionally recommended:

- P-1013412 High Voltage Power Supply E, 5 kV (230 V, 50/60 Hz)
- or
- P-1017725 High Voltage Power Supply E, 5 kV (115 V, 50/60 Hz)
- P-1002919 Rotary Vane Pump P 4 Z
- P-1012514 Pirani Vacuum Gauge
- P-1002923 2-Way Ball Valve DN 16 KF
- P-1002924 Crosspiece DN 16 KF
- P-1002929 Adaptor Flange DN 16 – Core NS 19/26
- P-1002926 Ventilation Valve DN 16 KF
- P-1002930 Tension Ring DN 10/16 KF (5x)
- P-1002931 KF External Centring Ring DN 10/16 KF (5X)



Experiment topics:

- Deflection of electrons in a closed circular path inside a magnetic field
- Determination of specific charge of an electron e/m



P-1019957

Fine Beam Tube on Connection Base R

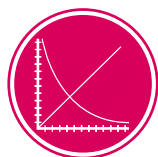
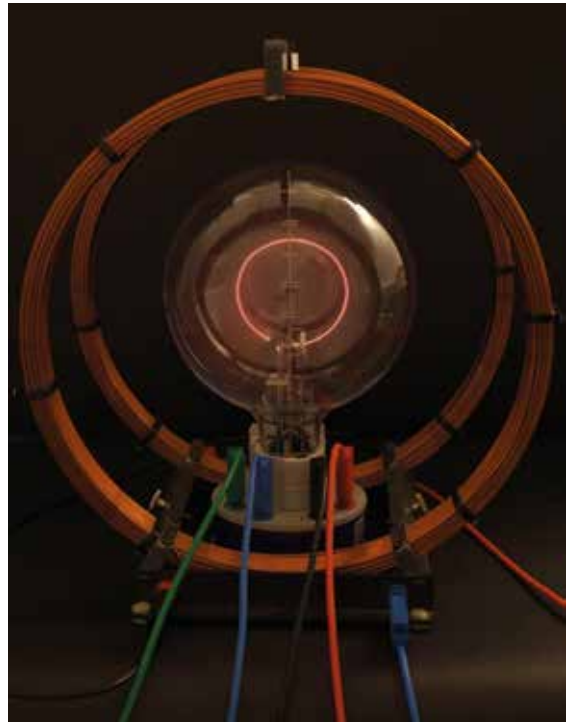
For examining the deflection of electron beams in a uniform magnetic field using a pair of Helmholtz coils (P-1000906) and for the quantitative determination of the specific charge of the electron e/m . Glass vessel with integrated electron beam system, consisting of an indirectly heated oxide cathode, a Wehnelt cylinder and a perforated anode, in neon residual gas atmosphere with precisely set gas pressure and with integrated measurement marks for parallax-free determination of the diameter of the fine beam. Gas atoms are ionized along the electron path and produce a sharply defined, visible fluorescent beam. Tube mounted on base with colour coded connectors.

| | |
|-------------------------|------------------------------------|
| Gas filling: | Neon |
| Gas pressure: | 1.3×10^{-5} hPa |
| Filament voltage: | 5 – 7 V DC |
| Filament current: | < 150 mA |
| Wehnelt voltage: | 0 – -50 V |
| Anode voltage: | 200 – 300 V |
| Anode current: | < 0.3 mA |
| Circular path diameter: | 20 – 120 mm |
| Division spacing: | approx. 20 mm |
| Tube diameter: | approx. 160 mm |
| Dimensions: | approx. 115x115x35 mm ³ |
| Weight: | approx. 820 g |

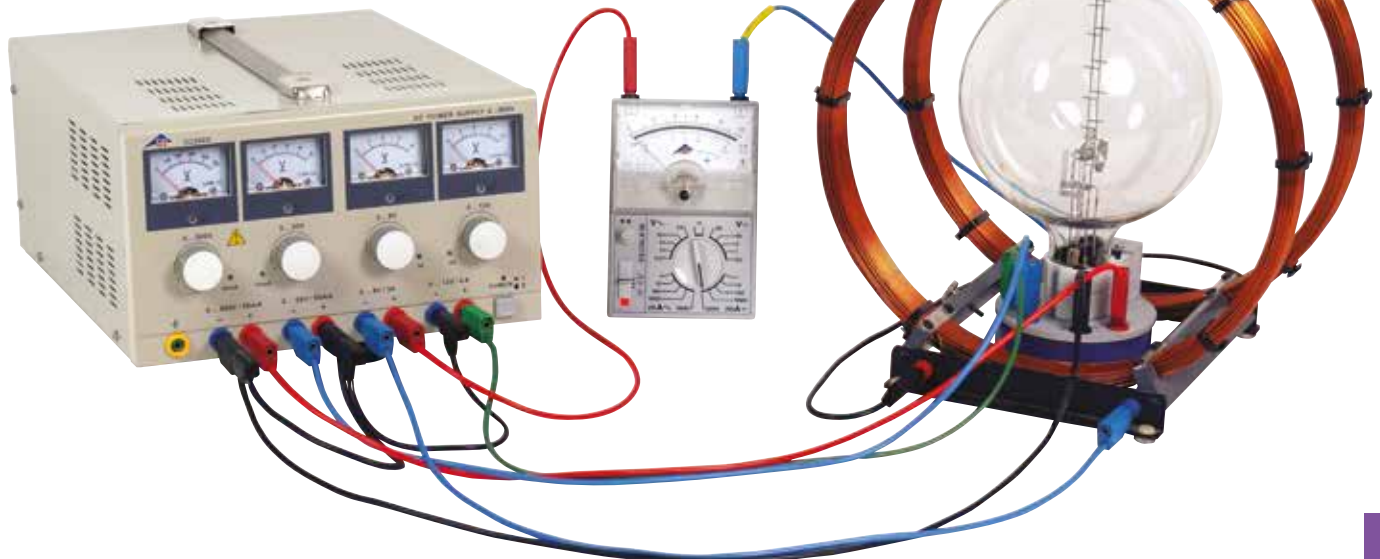
P-1019957

Additionally required:

- P-1000906 Helmholtz Coils, 300 mm**
- P-1003308 DC Power Supply, 0 – 500 V (230 V, 50/60 Hz)**
- or
- P-1003307 DC Power Supply, 0 – 500 V (115 V, 50/60 Hz)**



UE3070700
PDF online



Experiment topics:

- Electron deflection in a uniform magnetic field
- Closed orbit or spiral path
- Determining an electron's specific charge e/m

Complete Fine Beam Tube System

This complete experimental system is used to determine an electron's specific charge and investigate the deflection of electron beams in a uniform magnetic field. The system comes complete with a fine-beam tube, Helmholtz coil pair for generating a uniform magnetic field, and operating unit for power supply. The fine beam tube and Helmholtz coil pair are mounted on the operating unit, the fine beam tube being rotatable around its vertical axis. The tube and coil pair are both connected internally to the operating unit without a need for external wiring. All supply voltages for the tube and the current through the Helmholtz coils are adjustable. The anode voltage and coil current are displayed digitally and can be tapped additionally as equivalent voltage values. Inside the fine beam tube, a sharply delimited electron beam is generated by a system comprising an indirectly heated oxide cathode, perforated anode and Wehnelt cylinder. Impact ionization of neon atoms creates a very bright, also sharply delimited trace of the electron path in the tube. If the tube is aligned optimally and an appropriate current flows through the Helmholtz coils, the electrons are deflected into a circular orbit, whose diameter can be easily determined when the electrons strike one of the equidistant measurement marks, causing its end to light up. Diameter, anode voltage and magnetic field are the parameters used to determine the electron's specific charge. The magnetic field can be calculated from the coil current, the geometry of the Helmholtz coil pair being known.

Fine-beam tube:

| | |
|---------------------------|--------------------------|
| Gas filling: | Neon |
| Gas pressure: | 1.3×10^{-5} hPa |
| Bulb diameter: | 165 mm |
| Orbit diameter: | 20 – 120 mm |
| Measurement mark spacing: | 20 mm |

Helmholtz coil pair:

| | |
|-----------------|------------------------|
| Coil diameter: | approx. 300 mm |
| Winding count: | 124 |
| Magnetic field: | 0 – 3.4 mT (0.75 mT/A) |

Operating unit:

| | |
|---------------------|--------------------------------------|
| Coil current: | 0 – 4.5 A, 3-figure digital display |
| Measurement output: | $1 \text{ V}^* \text{IB} / \text{A}$ |
| Anode voltage: | 15 – 300 V, 3-figure digital display |
| Measurement output: | 0.01^*UA |
| Heating voltage: | 5 – 7 V |
| Wehnelt voltage: | 0 – -50 V |

General data:

| | |
|----------------------|--|
| Tube's rotary angle: | $-10^\circ - 270^\circ$ |
| Supply voltage: | 100 – 240 V, 50/60 Hz |
| Power supply cable: | EU, UK and US |
| Dimensions: | approx. $310 \times 275 \times 410 \text{ mm}^3$ |
| Weight: | approx. 7.5 kg |

P-1013843

The complete fine-beam tube system consists of the following parts:

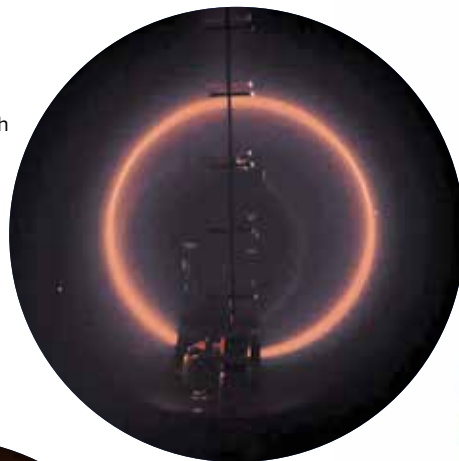
Fine Beam Tube T

P-1008505

Operating Unit for Fine-Beam Tube

P-1009948

Circular path



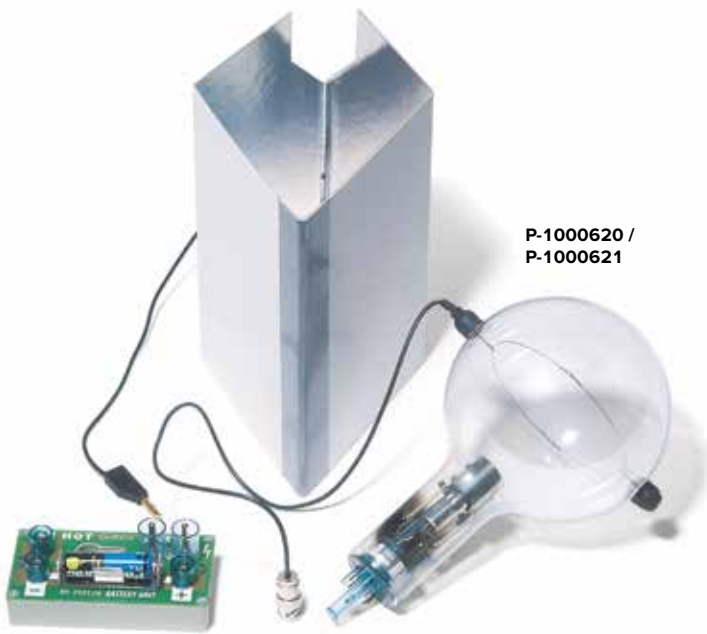
Recording in a darkened room



Spiral path



P-1009948



P-1000620 /
P-1000621



P-1008506
P-1000633

Gustav Hertz Experiment:

Gustav Hertz' experiment is a development of the Franck-Hertz experiment. Atoms are excited or even ionised by means of inelastic collisions with electrons inside an evacuated tube. If the kinetic energy of the electrons exactly matches a critical potential or ionisation level, the electrons transfer all their energy to the atoms and can then be drawn away to the collector ring in the tube with the help of a small voltage. At this point, the collector voltage reaches a maximum.

Critical Potentials Tube S

Hertz electron tube for quantitative investigations of inelastic collisions of electrons with inert gas atoms, determination of ionization energy of helium resp. neon, as well as resolution of the energy states of various primary and orbital angular-momentum quantum numbers. Includes shielding and battery unit for the collector voltage (battery not included).

Cathode filament

- voltage: $U_F \leq 7 \text{ V}$
- Anode voltage: $U_A \leq 60 \text{ V}$
- Anode current: $I_A \leq 10 \text{ mA}$
- Collector voltage: $U_C = 1.5 \text{ V}$
- Collector current: $I_C \leq 200 \text{ pA}$

Critical Potentials Tube S with He Filling

Critical potentials of helium:

- 2³S: 19.8 eV
- 2¹S: 20.6 eV
- 2³P: 21.0 eV
- 2¹P: 21.2 eV
- 3³S: 22.7 eV
- 3¹S: 22.9 eV
- 3³P: 23.0 eV
- 3¹P: 23.1 eV
- 4³S: 23.6 eV
- 4¹S: 23.7 eV
- Ionisation: 24.6 eV

P-1000620

Critical Potentials Tube S with Ne Filling

Critical potentials of neon:

- 2p⁵3s¹: 16.6 eV
- 2p⁵3p¹: 18.4 eV
- 2p⁵4s¹: 19.7 eV
- 2p⁵4p¹: 20.3 eV
- 2p⁵4d¹: 20.6 eV
- Ionisation: 21.6 eV

P-1000621

Control Unit for Critical Potentials Tubes

Control unit for operating the critical potentials tubes. Equipped with an output for sawtooth acceleration voltages; adjustable upper and lower limits of the acceleration voltage. Integrated pico-ammeter amplifier for anode current measurement. Allows recording of the acceleration voltage as a function of the anode current. A slow sawtooth voltage (approx. 6 seconds per cycle) is available with an interface or XY-recorder; a sawtooth voltage with a repetition rate of 20 Hz is available for oscilloscopic observations. Includes plug-in power supply.

Input: Anode current measurement via a BNC jack

Outputs:

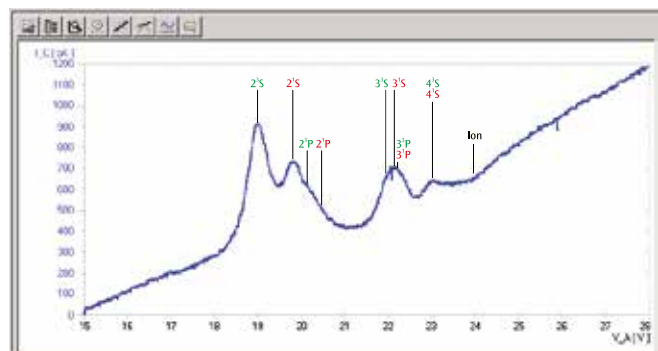
- Tube: Sawtooth acceleration voltage of 0 – 60 V, 20 Hz
- Fast: Voltage signal of 0 – 1 V, proportional to the acceleration voltage, for oscilloscopic observations
- Slow: Voltage signal of 0 – 1 V proportional to the acceleration voltage, for recording data with an XY-recorder or interface
- Anode current: Voltage signal of 0 – 1 V proportional to the anode current (1 V/nA)
- Supply voltage: 12 V AC
- Dimensions: approx. 170x105x45 mm³

Control Unit for Critical Potentials Tubes (230 V, 50/60 Hz)

P-1008506

Control Unit for Critical Potentials Tubes (115 V, 50/60 Hz)

P-1000633



Collector current I_R as a function of accelerating voltage U_A . Gas filling: He.



Experiment set-up with the control unit for critical potentials tubes

Experiment set-up with the control unit for critical potentials tubes

Additionally required:

P-1014525 Tube Holder S

P-1008506 Control Unit for Critical Potentials Tubes
(230 V, 50/60 Hz)

P-1003312 DC-Power Supply 0 – 20 V, 0 – 5 A
(230 V, 50/60 Hz)

or

P-1000633 Control Unit for Critical Potentials Tubes
(115 V, 50/60 Hz)

P-1003311 DC-Power Supply 0 – 20 V, 0 – 5 A
(115 V, 50/60 Hz)

Additionally recommended:

P-1002785 Digital-Multimeter P3340

P-1017264 USB Oscilloscope 2 x 50 MHz

P-1002748 HF Patch Cord, BNC/4 mm Plug (2x)

P-1002843 Set of 15 Safety Experiment Leads 75 cm

Experiment set-up with the control unit for the Franck-Hertz experiment

Additionally required:

P-1014525 Tube Holder S

P-1012819 Control Unit for the Franck-Hertz Experiment
(230 V, 50/60 Hz)

or

P-1012818 Control Unit for the Franck-Hertz Experiment
(115 V, 50/60 Hz)

Additionally recommended:

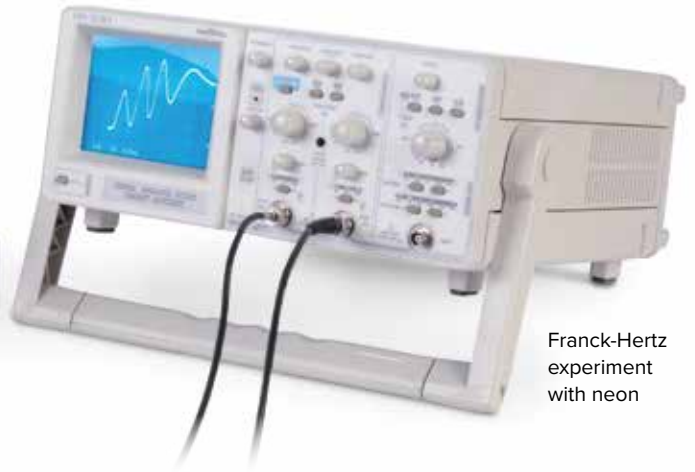
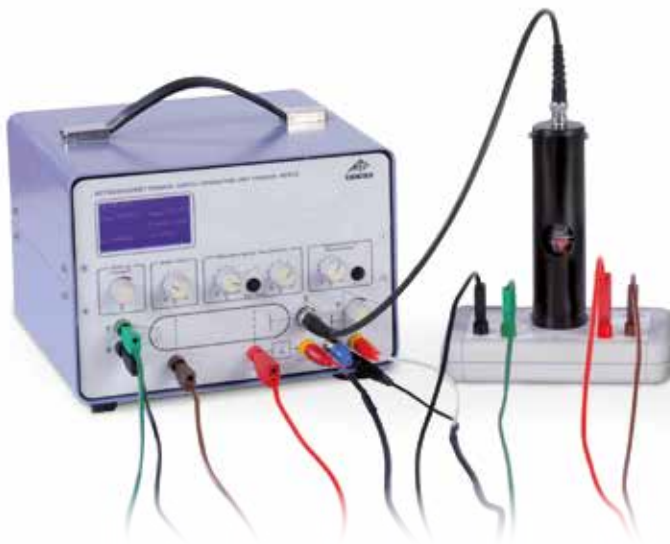
P-1017264 USB Oscilloscope 2 x 50 MHz

P-1002748 HF Patch Cord, BNC/4 mm Plug (2x)

P-1002843 Set of 15 Safety Experiment Leads 75 cm



Experiment set-up with the control unit for the Franck-Hertz experiment



Franck-Hertz experiment with neon

Franck-Hertz Experiment

The quantization of energy and the generation, recording and evaluation of spectra, along with the experimental verification thereof, is included in most of the curricula used around the world. The well known experiment first performed by James Franck and Gustav Hertz in 1913 is critically important in terms of demonstrating discrete energy states in atoms.

Power Supply Unit for Franck-Hertz Experiment

Power supply unit for operating the mercury filled Franck-Hertz tube (P-1006795 resp. P-1006794), the neon filled Franck-Hertz tube (P-1000912) or the critical potential tubes (P-1000620 and P-1000621). The equipment provides all the voltages needed to power the tubes and includes a sensitive built-in DC amplifier for measuring collector current. The voltages can simultaneously be read off a display. The accelerating voltage can be set-up manually on the apparatus or set to a saw-tooth wave form. Additional measuring inputs are also available for the anode current and accelerating voltage.

Filament voltage U_F : 4 – 12 V, continuously adjustable
 Control voltage U_G : 0 – 12 V, continuously adjustable
 Accelerating voltage U_A : 0 – 80 V
 Modes of operation: manually adjusted / saw-tooth
 Countervoltage U_E : 0 – ± 12 V, continuously adjustable, switchable polarity

Output U_E for collector current I_E : $I_E = U_A * 38 \text{ nA/V}$ (0 – 12 V)

Output U_x for accelerating voltage U_A : $U_x = U_A / 10$

Outputs: 4 mm safety sockets

Input: BNC socket

Dimensions: 160x132x210 mm³ approx.

Weight: 3.4 kg approx.



P-1012819
P-1012818

Power Supply Unit for Franck-Hertz Experiment (230 V, 50/60 Hz)

P-1012819

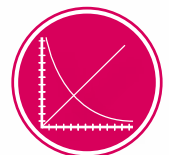
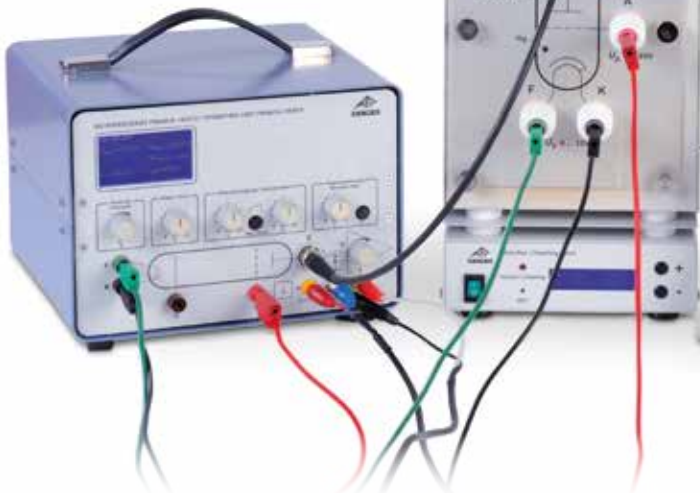
Power Supply Unit for Franck-Hertz Experiment (115 V, 50/60 Hz)

P-1012818



UE5020400
PDF online

Franck-Hertz experiment with mercury



UE5020300
PDF online



Franck-Hertz Tube with Neon Filling on Base

Highly evacuated electron tube containing neon, mounted on a base with socket connection for demonstrating that free electrons colliding with neon atoms emit energy in quantized packets and for determining the excitation energy of the 3P_0 or 3S_1 states at about 19 eV. When excited, these states emit visible light due to the energy drop from intermediate levels to a ground state at an excitation energy of about 16.7 eV. The light so emitted is in the red-yellow region of the spectrum. Parallel bands of light are formed between the control grid and the accelerator grid and can be observed through a window. The Franck-Hertz neon tube can be operated at room temperature. Tetrode with indirectly heated cathode, mesh control grid, mesh accelerating grid and collector (counter) electrode. Mounted on a base with colour coded connection sockets.

- Filament voltage: 4 – 12 V
- Control voltage: 9 V
- Accelerating voltage: max. 80 V
- Counter voltage: 1.2 – 10 V
- Tube: 130 mm x 26 mm diam. approx
- Base with connector sockets: 190x115x115 mm³ approx.
- Weight: 450 g approx.

P-1000912

Additionally required:

P-1012819 Power Supply Unit for Franck-Hertz Experiment (230 V, 50/60 Hz)

or

P-1012818 Power Supply Unit for Franck-Hertz Experiment (115 V, 50/60 Hz)

P-1002727 Analogue Oscilloscope 2x30 MHz

Franck-Hertz Tube with Mercury Filling and Heating Chamber

Highly evacuated electron tube containing mercury in a heating chamber for demonstrating the discrete nature (quantization) of the energy released by free electrons in collisions with mercury atoms, and for determining the excitation energy of the mercury resonance line ($6^1S_0 - 6^3P_1$), which is 4.9 eV. The electron tube must be heated in the chamber to generate the necessary mercury vapour pressure to achieve a sufficiently high probability of collisions between electrons and mercury atoms. Electron tube with a plane parallel electrode system consisting of an indirectly heated oxide cathode with aperture, a grid and a collecting electrode. Front plate with printed tube symbol visible from a distance. Electric heating chamber with continuous temperature control and digital temperature display showing actual and set-point temperatures. In lacquered metal housing with two observation windows, opening with spring clip for thermometer, and thermally insulated carrying handle. Temperature measurement and control is handled by an integrated microcontroller and a Pt100 thermocouple.

- Heater voltage: 4 – 12 V
- Grid voltage: 0 – 70 V
- Suppressor voltage: 1.5 V approx.
- Tube dimensions: 130 mm x 26 mm diam. approx.
- Heater output: 400 W
- Temperature range: 160° C – 240° C
- Temperature constancy: ±1°C approx.
- Overall dimensions: 335x180x165 mm³ approx.
- Weight: 5.6 kg approx.

Franck-Hertz Tube with Mercury Filling and Heating Chamber (230 V, 50/60 Hz)

P-1006795

Franck-Hertz Tube with Mercury Filling and Heating Chamber (115 V, 50/60 Hz)

P-1006794

Additionally required:

P-1012819 Power Supply Unit for Franck-Hertz Experiment (230 V, 50/60 Hz)

or

P-1012818 Power Supply Unit for Franck-Hertz Experiment (115 V, 50/60 Hz)

P-1002727 Analogue Oscilloscope 2x30 MHz



P-1000912



P-4008614

P-1003549

P-1006795
P-1006794



Replacement Tubes for Frank-Hertz Experiment

Franck-Hertz Tube with Hg P-1003549

Franck-Hertz Tube with Ne P-4008614



Experiment set-up for transmissive illumination of sodium fluorescence tube with a beam of white light

Experiment Topics:

- Sodium resonance fluorescence
- Absorption of Na spectral lines in a sodium mist

Sodium Fluorescence Tube on Furnace Wall

Highly evacuated glass tube containing multiply distilled sodium for demonstrating the resonance fluorescence of sodium vapour. Filled with argon. The tube is heated in the furnace up to temperatures of between 180°C and 200°C in order to achieve sufficient pressure of sodium vapour. The entire tube emits yellow light at the wavelength of the sodium D line when it is brought to the heated state and illuminated with sodium spectral light. The sharply defined sodium D line appears in the spectrum. If it is instead illuminated with white incandescent filament light, the transmitted light exhibits a dark absorption line at the position of the sodium D line. Absorption can be demonstrated even without the use of a spectrometer due to the clear shadow formed when yellow sodium light passes through the tube.

Dimensions of tube: 170 mm x 42 mm diam.
 Dimensions of hotplate: 230x160 mm² approx.
 Weight: 550 g approx.

P-1000913

Additionally required:

P-1012820 Heating Chamber (230 V, 50/60 Hz)

or

P-1006796 Heating Chamber (115 V, 50/60 Hz)

Additionally recommended:

P-1003541 Sodium Vapour Spectrum Lamp

P-1003196 Choke for Spectrum Lamps (230 V, 50/60 Hz)

or

P-1003195 Choke for Spectrum Lamps (115 V, 50/60 Hz)

P-1003188 Optical Lamp, Halogen

P-1000593 Transformer 12 V, 60 VA (230 V, 50/60 Hz)

or

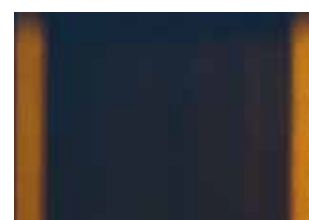
P-1006780 Transformer 12 V, 60 VA (115 V, 50/60 Hz)

P-1002835 Tripod Stand, 150 mm

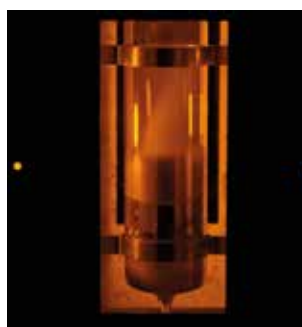
P-1003022 Convex lens on stem, 50 mm

P-1001045 Barrel Foot, 0.9 kg

P-1003531 Hand Held Spectroscope with Amici Prism



Absorption of white light (left) and yellow sodium light (right) in a glass tube containing sodium vapour. In each case, the light is dispersed far enough for it to pass unobstructed to the left and right of the tube.



Observation of sodium vapour in yellow sodium light



P-1012820
P-1006796

Heating Chamber

Electric heating chamber with continuous temperature control and digital temperature display showing actual and set-point temperatures. In lacquered metal housing with two viewing windows, opening with spring-clip for thermometer and thermally insulated carrying handle. Temperature measurement and control is handled by an integrated microcontroller and a Pt100 thermocouple.

Dimensions of front opening: 230x160 mm² approx.
 Heating power: 400 W
 Maximum temperature: 300°C (230 V, 50/60 Hz)
 250°C (115 V, 50/60 Hz)
 Temperature constancy: ±1°C approx.
 Dimensions: 335x180x165 mm³ approx.
 Weight: 5.6 kg approx.

Heating chamber (230 V, 50/60 Hz)

P-1012820

Heating chamber (115 V, 50/60 Hz)

P-1006796



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Electron Deflection Tube D

Highly evacuated electron tube with focusing electron gun and fluorescent screen inclined relative to the beam axis, so that the path of the beam can be seen and the effects of electric and magnetic fields can be studied.

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