

Bragg Driver

The Bragg driver is a combination of hardware and software which allows the user to collect X-ray diffraction data in combination with the X-ray apparatus (9983-1000657 resp. 9983-1000660). It provides the high voltage and counting circuitry for the Geiger Müller tube (9983-1000661) and includes a software program that allows the user to control the driver and collect data. It includes the USB powered drive, a drive gear, an USB cable and a powder compressor. Scans can be obtained for all crystals available in the basic equipment set (9983-1000665) and the crystallography accessories (9983-1000666). An additional feature includes the ability to scan powders and foils. The software allows selection of scan angles, resolution, and time per step. Once the experiment is completed the software permits zoom-in on the data and the facility to add comments to the file. Data can be exported to a spreadsheet for further analysis.

Time interval for automatic data saving:	30 s
Angular range:	12° – 120°
Time per step:	≥ 0.1 s
Angular step:	≥ 0.05°
GM tube voltage:	0 – 1000 V

9983-1012871

NEW

9983-1012871



Recommended equipment:

Art. No.		Basic	Intermediate	Advanced
9983-1000657 or 9983-1000660	X-ray Apparatus	yes	yes	yes
9983-1000661	Geiger Müller Tube	yes	yes	yes
9983-1012871	Bragg Driver	yes	yes	yes
9983-1000665	Basic Equipment Set	yes	yes	yes
9983-1000666	Crystallography Accessories		yes	yes
9983-1000667	Radiography Accessories			yes
9983-1000663/ 9983-1000662	Motor Drive		yes	yes
9983-1000669	Film-pack2	yes	yes	yes
9983-1000670	Film-pack 4	yes	yes	yes

Basic:

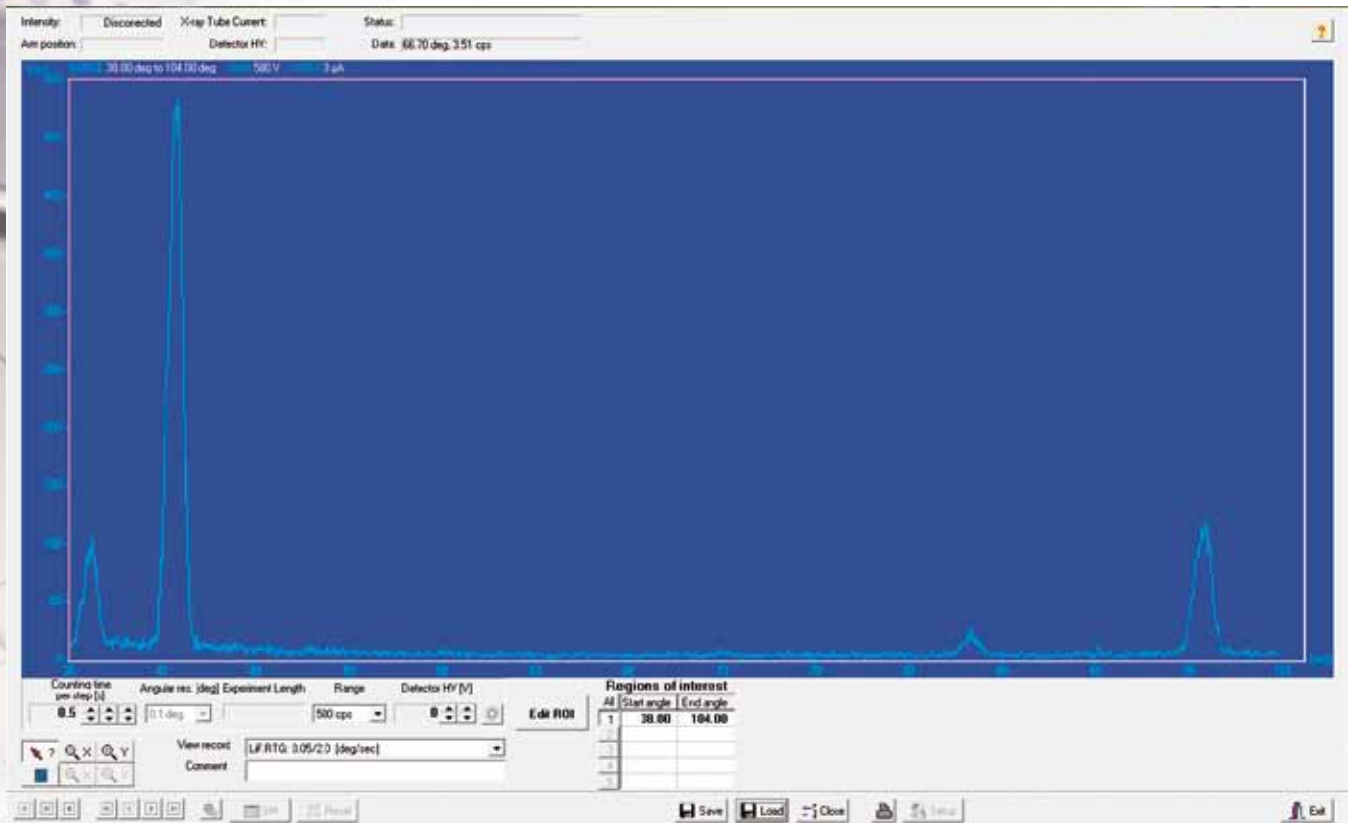
Basic experiments using photographic techniques and Geiger Müller tube like Laue experiments, Bragg diffraction experiments, experiments on inverse square law, emission, rectilinear propagation, penetration and absorption of X-rays.

Intermediate:

Basic experiments and experiments on Moseley, Debye-Scherrer diffraction, size of the unit cell in salt crystals in addition.

Advanced:

Intermediate experiments and experimental investigations into radiography, film and the properties of x-rays in addition.



X-ray Energy Detector

X-ray detector for recording energy spectra of X-rays or γ radiation in the energy range of approx. 2 keV to 60 keV. It mainly consists of a Si-PIN photodiode which is integrated in a metal housing together with a charge sensitive preamplifier, a main amplifier with pulse shaping and a digital signal processing circuit. The detector holder is particularly designed for installation on the swiveling arm of the X-ray apparatus (9983-1000657 resp. 9983-1000660). The power supply is ensured via the USB port of a PC. Including CD with measuring and evaluation software for PC.

- Energy range: approx. 2 keV up to 60 keV
- Energy resolution (FWHM): 0.55 keV at $E_{FeK\alpha} = 6.40$ keV
- Entrance window: Plastics (absorption equivalent to Graphite with $d = 40 \mu\text{m}$)
- Detector: Si-PIN photo diode
- Active Area: 0.8 mm diam.
- Thickness: approx. 200 μm
- Dead time per pulse: approx. 200 μs
- Connection: USB
- Cable length: 1.75 m
- Dimensions: 80 mm x 22 mm diam.
- Mass: 150 g

9983-1008629

Additionally required:

- 9983-1000657 X-Ray Apparatus (230 V, 50/60 Hz)**
- 9983-1000660 X-Ray Apparatus (115 V, 50/60 Hz)**

Additionally recommended:

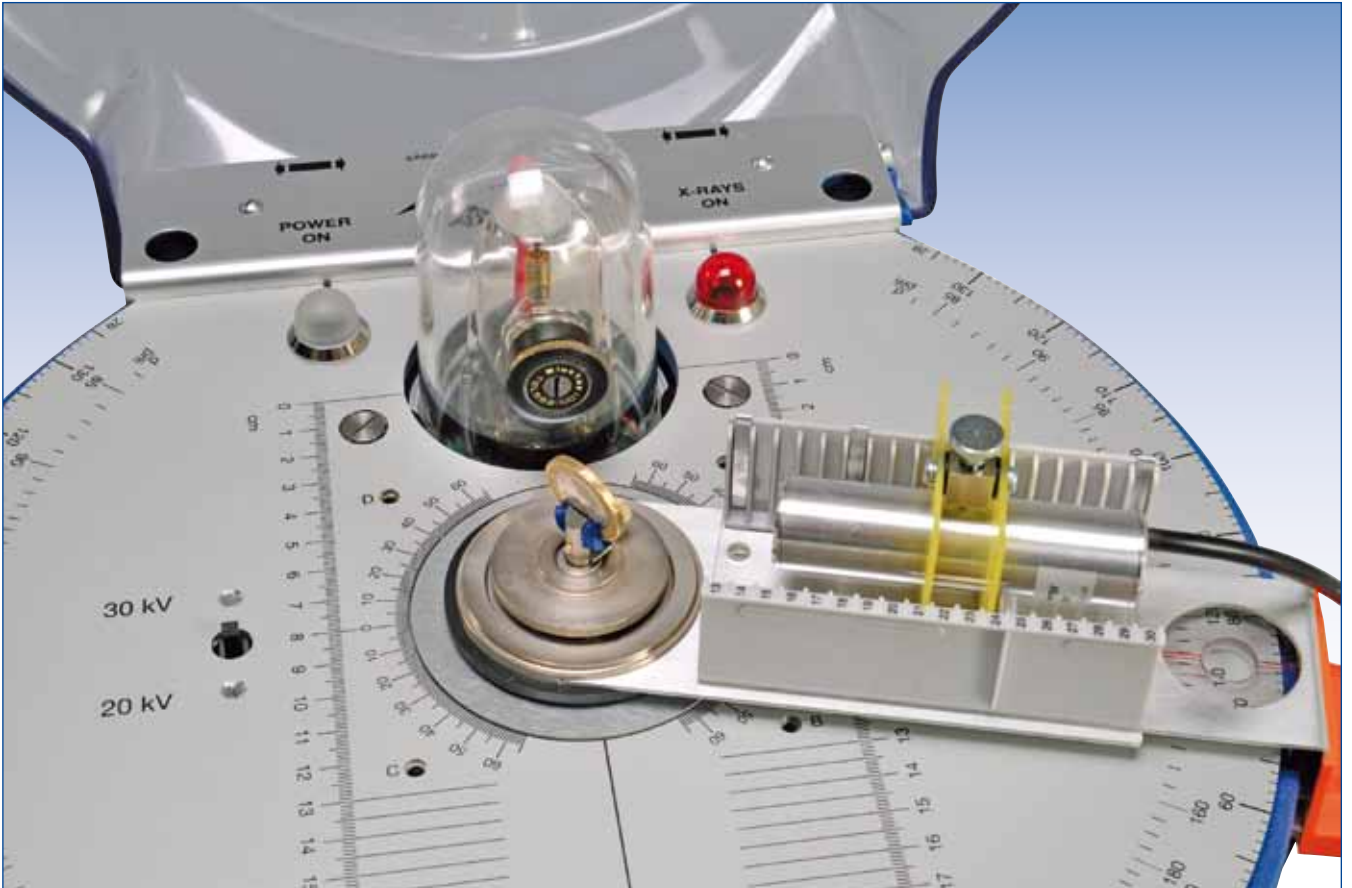
- 9983-1012868 Set of Fluorescence Samples**

Experiment Topics:

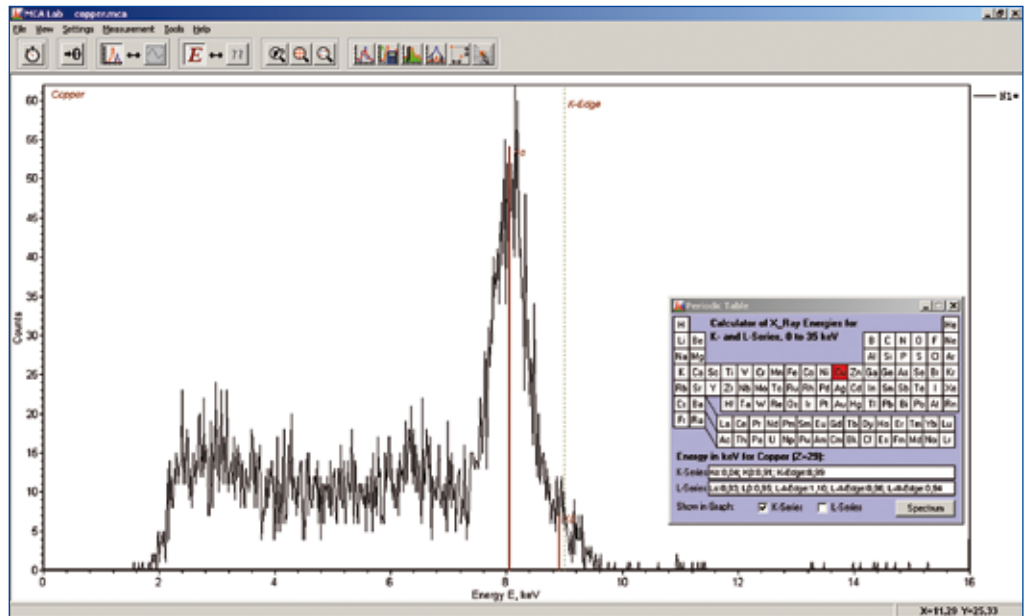
- X-ray energy spectroscopy
- Compton effect
- X-ray fluorescence spectroscopy
- Absorption experiments
- Bragg's reflection
- Duane-Hunt's displacement law
- Moseley's law



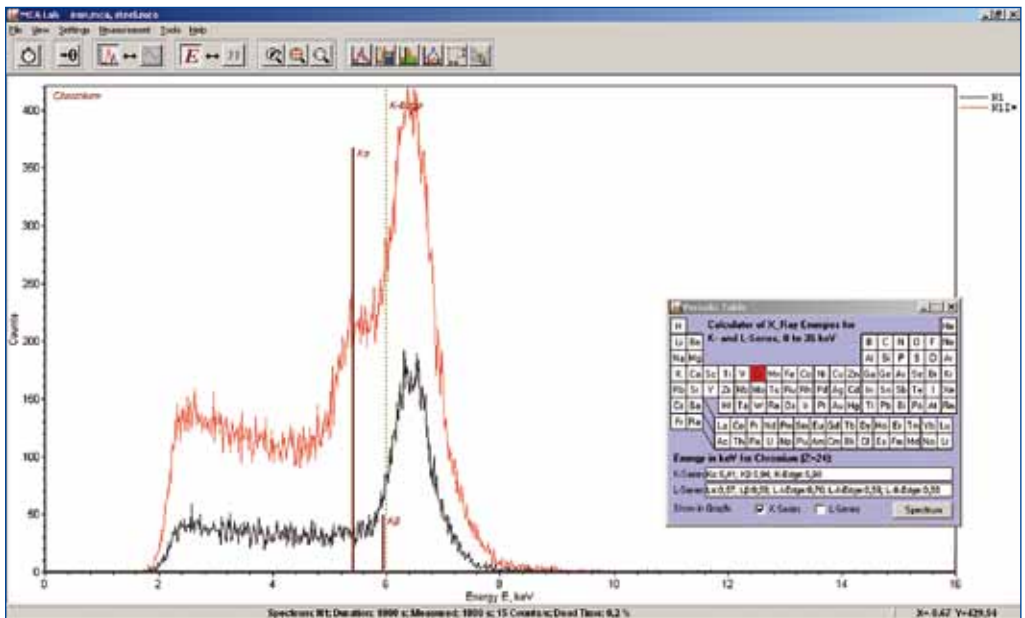
9983-1008629



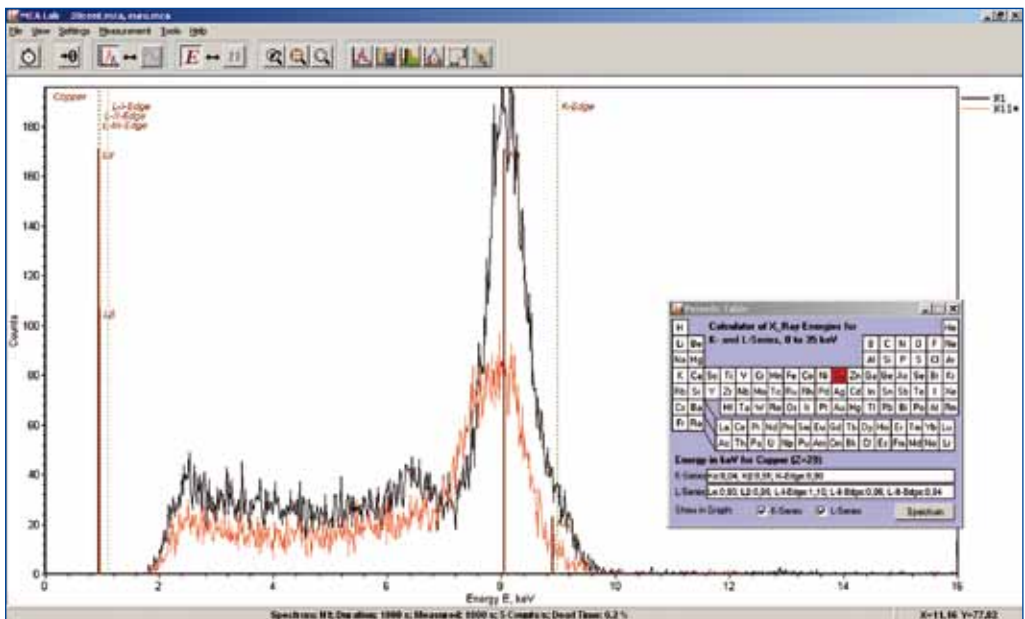
Energy spectrum of a copper anode



Comparing the x-ray fluorescence spectra of iron (black) and stainless steel (red)



Comparing the x-ray fluorescence spectra of two different coins





9983-1000628

9983-1000635
9983-1000634

Pico-Ammeter Amplifier

Current amplifier for measuring electrical currents in the pico-ampere range. With zero-point adjustment; the measured currents can be fed via the voltage output to an XY-recorder, interface or other measuring device. Includes a jack.

Measuring ranges: 0 to ±200 nA
0 to ±20 nA
0 to ±2 nA
0 to ±200 pA
via a BNC jack

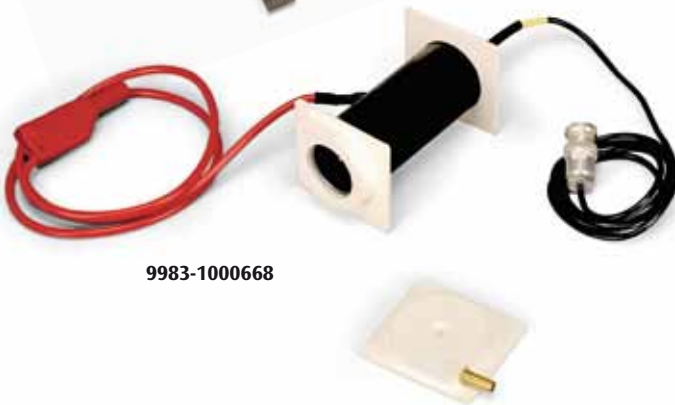
Additionally: 0 to ±200 µA via a jack
Voltage output: 0 to 1V, proportional to the set measuring range via 4 mm jacks

Dimensions: 170x105x45 mm³

9983-1000628

Additionally required:

9983-1000635 Plug in Power Supply TEL (230 V, 50/60 Hz)
or
9983-1000634 Plug in Power Supply TEL (115 V, 50/60 Hz)



9983-1000668

Ionization Chamber

Intended for investigating the ionization of air and other gases brought about by X-radiation at different pressures (saturation characteristics, model of a Geiger-Müller tube, dosimetry). Possesses a cylinder-shaped cathode, rod-anode and hose shaft for evacuating and introducing gases.

Operating voltage: max. 2 kV
Ionization current: 10⁻¹¹ – 10⁻¹⁰ A
Rod-electrode: approx. 75 mm long
Chamber: approx. 85 mm x 25 mm diam.
Hose shaft: approx. 5 mm diam.

9983-1000668

Additionally required:

9983-1000628 Pico-Ammeter Amplifier

Set of Fluorescence Samples

Set of 7 samples for material analysis with the X-ray energy detector (9983-1008629). The material composition can be determined from the energies of the appropriate X-ray fluorescence lines. Thus, for example the difference between stainless and low carbon steel, or between copper, brass and bronze can be seen clearly.

Materials:

Stainless Steel S321, Low Carbon Steel, Copper C101, Brass C260, Bronze C220, Zinc and Lead.

9983-1012868



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Plug in Power Supply TEL

Plug in Power supply with an electronically regulated output voltage. Connecting lead with a 6-pole, self locking special plug.

Lead length: approx. 1 m
Output: 12 VDC, 400 mA

Plug-in Power Supply TEL (230 V, 50/60 Hz)

9983-1000635

Plug-in Power Supply TEL (115 V, 50/60 Hz)

9983-1000634

Film-pack 2

Highly sensitive film (38x35 mm²) for α-, β- and X-radiation. Single packaging in opaque plastic cases allows development and fixing in daylight (duration: approx. 6 minutes).

Contents:

- 20 film sheets (38x35 mm²) in light-tight plastic cases
- 1 bottle of X-ray developer
- 1 bottle of X-ray fixer
- 1 syringe with a cannula for introducing chemicals into the film cases
- 1 metal clip

9983-1000669

Film-pack 4

Like 9983-1000669, but consisting of 12 film sheets, 150x12 mm², in light-tight plastic cases for a Debye-Scherrer camera.

9983-1000670



9983-1000669

9983-1000670