



X-ray unit, 35 kV, basic unit

09058.99

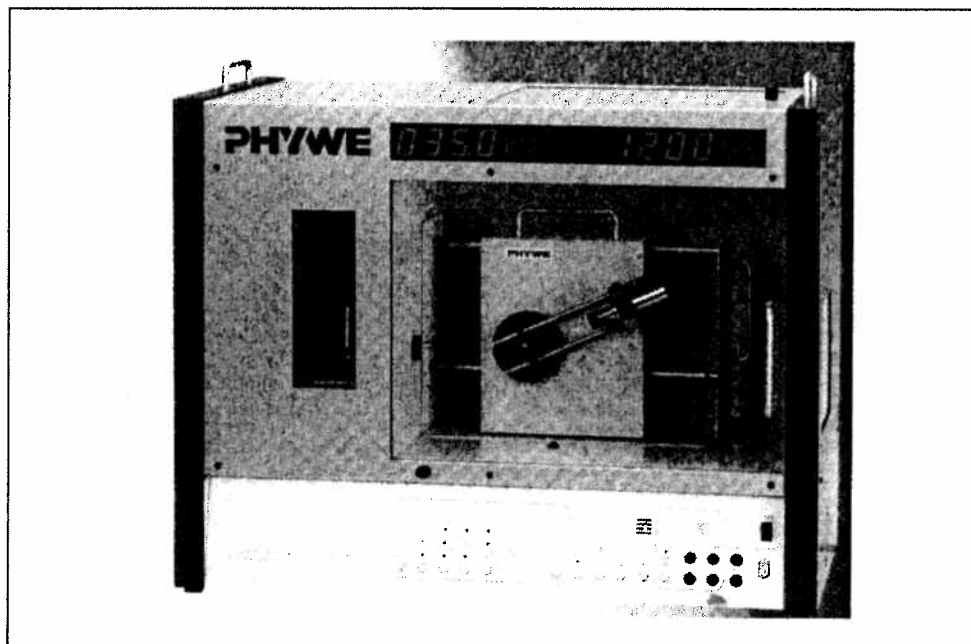
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Operating Instructions



The unit complies
with the corresponding
EC guidelines.



Contents	Page	Contents	Page
A GENERAL INFORMATION	2	F ACCESSORIES	8
1. Requirements of the German X-ray Regulations	2	G NOTES ON EXPERIMENTS	8
2. Safety precautions	2	1. Laue and Debye-Scherrer photographs	8
3. Purpose of the unit	2	2. Compton scattering	9
B DESCRIPTION OF THE COMPONENTS	3	3. Registration of X-ray spectra	9
1. The basic unit	3	4. Monochromatization of X-rays	9
2. The experimenting area	3	5. Absorption experiments	9
3. The control panel	4	6. Ionizing power of X-rays	10
4. The observation window	5	H SPECIFICATIONS	10
5. The digital displays	5	I APPENDIX	11
6. The tube-insert compartment	5	1. Energy levels of various anode materials	11
7. The accessory box	5	2. Characteristic X-ray lines of various anode materials	11
C THE X-RAY TUBE INSERTS	5	3. Lattice constants and lattice plane spacing of various crystals	11
D THE GONIOMETER	6	4. Edge absorption of some elements	11
E HANDLING	7	5. Mass weakening coefficient of some substances	12
1. Switching the basic unit on	7	J NOTE ON THE GUARANTEE	12
2. Fitting in and changing X-ray tube inserts	7		
3. Using an X-ray tube insert			
3.1 First use of an X-ray tube insert	7		
3.2 Setting the tube operating values	7		
4. Setting the exposure time	7		
5. Using the goniometer	7		
5.1 Manual operation	7		
5.2 Automatic operation	7		
5.3 Re-adjusting the goniometer	7		
5.4 Data output	7		
6. Changing the fuse	8		

A GENERAL INFORMATION

1. Requirements of the German X-ray Regulations

The operation of an X-ray apparatus is governed in Germany by the requirements stipulated in the X-ray Regulations. This X-ray unit fulfils the obligatory conditions specified in these Regulations, not only as an X-ray apparatus for educational use in schools, but also as a completely protected apparatus.

The operation of the unit does not require official permission, but it is obligatory to report it. This can be done by filling out a form and submitting it to the responsible authorities. The unit must only be operated by staff who have been appropriately trained and instructed.

When the unit is running at the specified maximum values, the local dosage rate at a distance of 0.1 m from the parts of the casing which can be touched is less than 1 $\mu\text{Sv/h}$. This value corresponds roughly to the natural radiation dose.

Two safety circuits which act independently of each other monitor the opening of the sliding door to the experimenting area. The production of X-rays is only possible when this sliding door is properly locked. Safety circuits also prevent the maximum permissible tube operating specifications from being exceeded.

The authorization to operate the unit expires as soon as manipulations other than those required to set it up, or to carry out experiments, are carried out on the unit. The safety screws on the steel sheet casing must on no account be detached. Repairs are to be carried out exclusively by the manufacturer.

2. Safety precautions

As the X-ray unit produces radiation which is hazardous to health, it must only be operated by appropriately instructed and qualified staff.

During the handling of the X-ray unit, all of the obligatory measures and duties detailed in the X-ray Regulations must be strictly followed.

The operator must pay particular attention to the following:

- The X-ray unit must be so protected that it cannot be accessed by unauthorized persons.
- The X-ray unit should not be kept in operation for longer than necessary.
- When the unit is in operation, no person should stay longer than necessary in its immediate vicinity.

Operation of the unit is forbidden, when

- the sliding door which is made of acrylic glass containing lead and opens the experimenting area, or the protective glass window for observation of the X-ray tube, or the fluorescent screen is damaged.
- the ventilator on the tube insertion side inside the unit does not work (acoustic test).
- the safety circuits for interrupting the operation of the tube on opening the sliding door do not work flawlessly.

3. Purpose of the unit

The X-ray unit has been specially developed to fulfil the needs of an educational unit for demonstration purposes and for practical work in schools and high schools. In addition to its application in teaching Physics, however, it is also excellently suitable for use in medical technology and related technical disciplines. A particularly noteworthy distinguishing feature of this microprocessor-controlled compact unit is the quick-tube-change technique, which enables experiments to be carried out with diverse X-ray tubes having different anode materials.

The available choice of X-ray tubes, each prepared ready-

for-use as a special insert, is as follows:

- Insert with Cu X-ray tube Order no. 09058.50
- Insert with Mo X-ray tube Order no. 09058.60
- Insert with Fe X-ray tube Order no. 09058.70

Alongside simple fluoroscopic experiments and experiments on dosimetry, the use of the rate-meter installed in the unit and the goniometer, which is available as accessory, enable spectroscopic experiments on atomic physics and solid-state physics to be carried out.

X-ray spectra can be registered with a directly connected xy-recorder or a computer. All operating and controlling parameters can be set either manually or with a computer.

Two demonstrative digital displays serve both to present all operating and controlling parameters as well to display measured values.

The following experiments can be carried out with the X-ray unit and appropriate accessories:

- Radiation through objects using a luminous screen for observation
- Preparation of X-ray films from irradiated objects
- Detection of the ionizing effect of X-rays (dosimetry)
- Detection of Bragg reflection
- Registration of X-ray spectra
- Determination of the characteristic X-ray lines of various anode materials (Cu, Mo, Fe), thereby verifying Moseley's Law
- Detection of the characteristic lines $K\alpha_1$ and $K\alpha_2$ in higher order diffraction
- Monochromatisation of X-rays with single-crystals or metal foil
- Analysis of crystal structure by means of X-ray spectroscopy, the Laue and Debye-Scherrer methods
- Determination of Planck's quantum of action from the short-wave limit of the retardation spectrum (Duane-Hunt's Law of Displacement)
- Determination of the Rydberg constant
- Determination of absorptions coefficients as function of the thickness and the atomic number of the absorber material and the photon energy
- Detection of edge absorption
- Demonstration of the action of contrast media in medicine
- Compton scattering