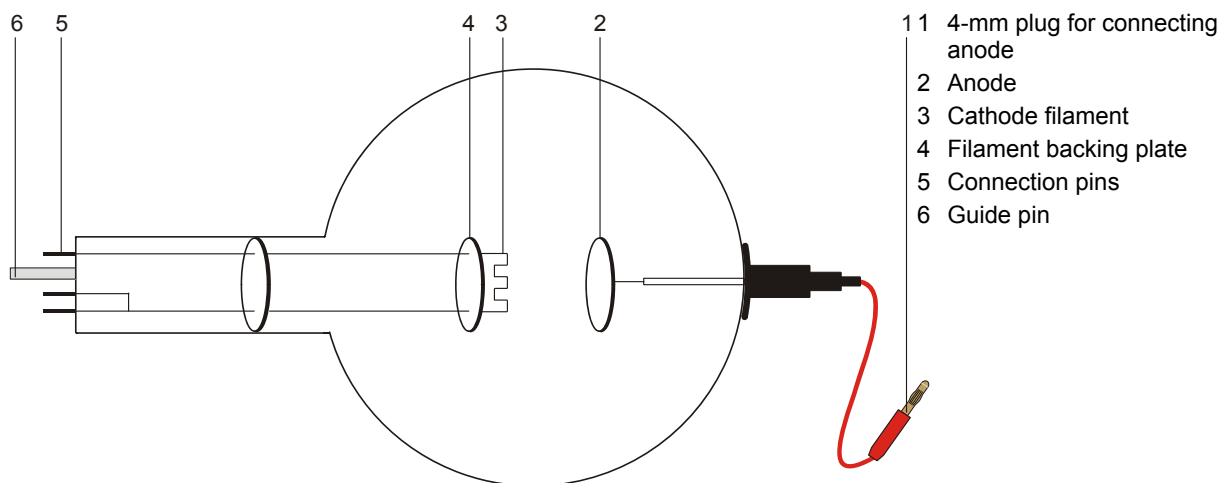


## Diode S 1000613

### Instruction sheet

12/12 ALF



### 1. Safety instructions

Hot cathode tubes are thin-walled, highly evacuated glass tubes. Treat them carefully as there is a risk of implosion.

- Do not subject the tube to mechanical stresses.
- Do not subject the cable connected with the anode to any tension.
- The tube may only be used with tube holder S (1014525).

If voltage or current is too high or the cathode is at the wrong temperature, it can lead to the tube becoming destroyed.

- Do not exceed the stated operating parameters.

When the tube is in operation, the terminals of the tube may be at high voltages with which it is dangerous to come into contact.

- Only use safety experiment leads for connecting circuits.
- Only change circuits with power supply equipment switched off.
- Only exchange tubes with power supply equipment switched off.

When the tube is in operation, the stock of the tube may get hot.

- Allow the tube to cool before dismantling.
- The EC directive on electromagnetic compatibility is only guaranteed when using the recommended power supplies.

### 2. Description

The diode allows basic experiments to be performed on the Edison effect (thermionic effect), demonstrates how the emission current depends on the power supplied to heat the hot cathode, allows recording diode characteristics and shows the use of the diode as a rectifier. The diode is a highly evacuated tube with a pure tungsten heater filament (cathode) and a circular metal plate (anode) inside a clear glass bulb. The cathode filament and the anode plate are parallel to one another. This planar configuration corresponds to the conventional symbol for a diode. A circular metal plate mounted behind the filament ensures that the electric field between the anode and cathode is uniform.

### 3 Technical data

Filament voltage:	$\leq 7.5 \text{ V}$
Filament current:	$\leq \text{ca. } 3 \text{ A}$
Anode voltage:	$\leq 500 \text{ V}$
Anode current:	2.5 mA typical at $U_A = 300 \text{ V}$ , $U_F = 6.5 \text{ V DC}$
Length of tube:	240 mm approx.
Diameter:	130 mm approx.
Spacing between cathode and anode:	15 mm approx.

### 4. Operation

To perform experiments using the diode, the following equipment is additionally required:

1 Tube holder S	1014525
1 Power supply 500 V (115 V, 50/60 Hz)	1003307
or	
1 Power supply 500 V (230 V, 50/60 Hz)	1003308

#### 4.1 Setting up the diode in the tube holder

- The tube should not be mounted or removed unless all power supplies are disconnected.
- Press tube gently into the stock of the holder and push until the pins are fully inserted. Take note of the unique position of the guide pin.

#### 4.2 Removing the diode from the tube holder

- To remove the tube, apply pressure with the middle finger on the guide pin and the thumb on the tail-stock until the pins loosen, then pull out the tube.

### 5. Sample experiments

#### 5.1 Generation of charge carriers by a hot cathode (thermionic effect) and measurement of the anode current in dependency on the power supplied to the cathode filament

Additionally required:

- |                            |         |
|----------------------------|---------|
| 1 Analogue multimeter AM50 | 1003073 |
|----------------------------|---------|
- Set up the circuit as in Fig. 1.
  - Start with the filament cold (filament voltage  $U_F = 0$ ).
  - Vary the anode voltage  $U_A$  between 0 and 300 V.

Practically no current ( $< 0.1 \mu\text{A}$ ) flows between the cathode filament and the anode, even at high voltages.

- Apply 6 V to the filament so that it gets hot, gradually increase the anode voltage and measure the anode current  $I_A$ .
- Set the filament voltage back to zero, let it cool, then gradually increase the filament voltage with a fixed anode voltage and observe the effect on the anode current.

When the filament voltage is fixed, the anode current increases in proportion to the anode voltage.

With the anode voltage fixed, the anode current increases in proportion to the filament voltage.

#### 5.2 Recording diode characteristics

- Set up the circuit as in Fig. 1.
- Set filament voltages of 4.5 V, 5 V and 6 V.
- Determine how the anode current  $I_a$  depends on the anode voltage  $U_A$  for each of the filament voltages by raising the anode voltage step by step from 40 V to 300 V.
- Plot the values of  $I_A$  and  $U_A$  on a graph.

With increasing the anode voltage the anode current rises to an approximately steady value known as the saturation current.

With increasing the filament voltage the anode current rises.

#### 5.3 Diode rectifier

Additionally required:

- |                          |
|--------------------------|
| 1 10 k $\Omega$ resistor |
| 1 16 V AC power supply   |
| 1 Oscilloscope           |

- Set up the circuit as in Fig. 3 with  $U_F = 6.3 \text{ V}$  and  $U_A = 16 \text{ V AC}$ .
- Using an oscilloscope to measure the voltage across the 10 k $\Omega$  resistor, observe the rectifier operation of the diode.

When the anode circuit operates as a diode, an AC voltage is rectified in that during one half of the current waveform the current is prevented from flowing.

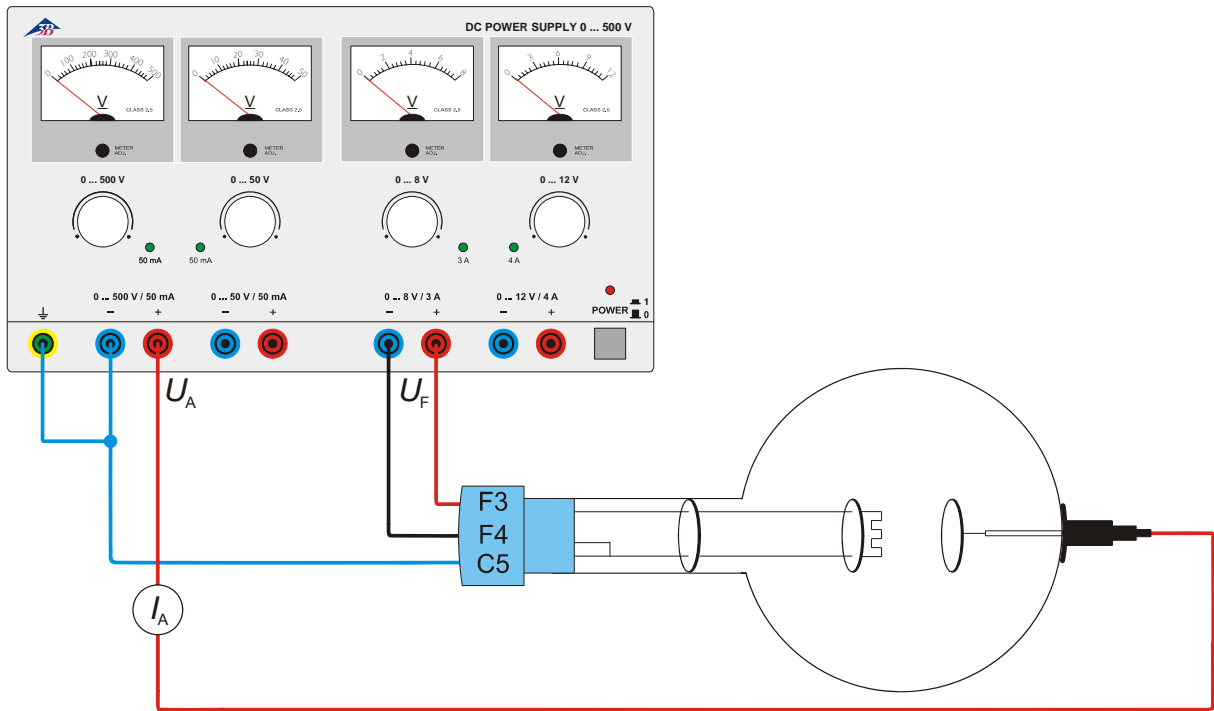


Fig. 1 Determining dependency of anode current on filament voltage and confirmation of anode current using a meter

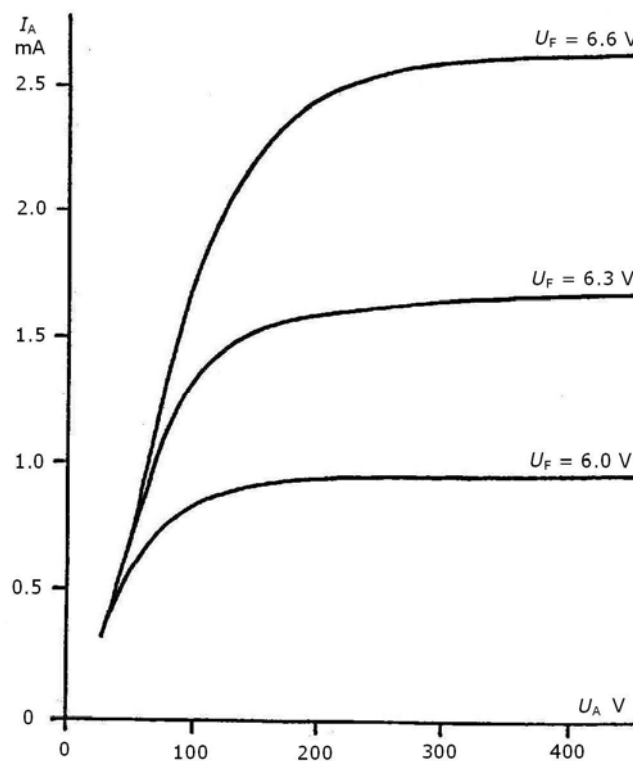


Fig. 2 Diode characteristics: anode current as a function of anode voltage

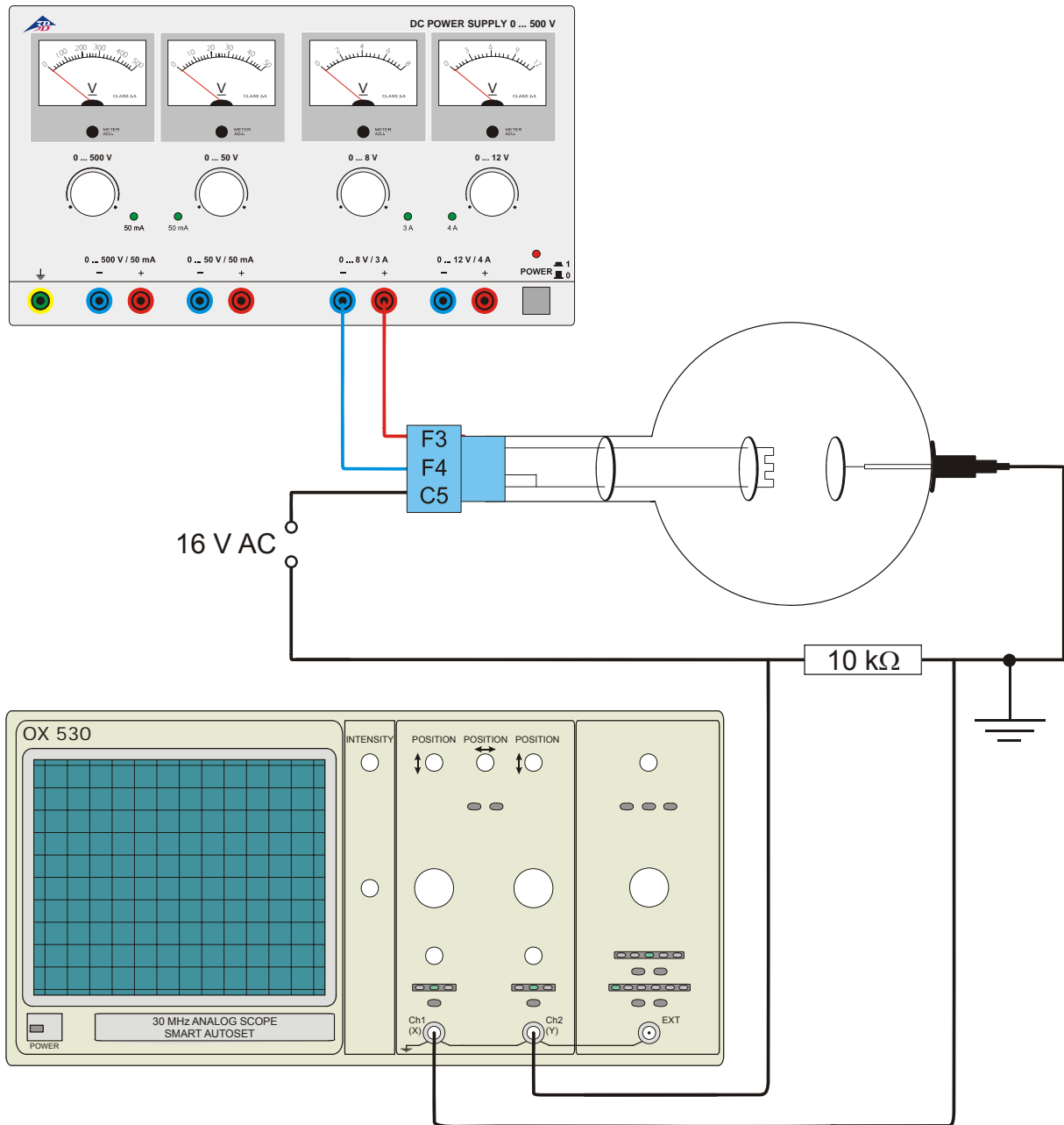


Fig. 3 Diode rectifier