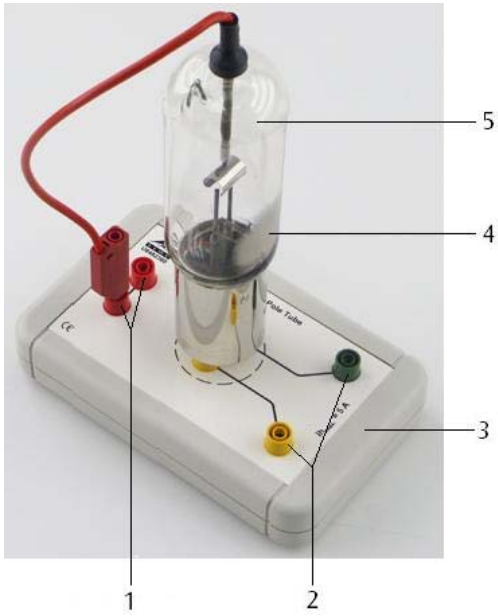
Dual Pole Tube U8482360

Instruction Sheet

10/10 LT/ALF



1 Anode terminal
2 Sockets for heater voltage
3 Base
4 Getter
5 Dual pole tube

1. Safety Instructions

When the instrument is used in accordance with the instructions and regulations, safe operation is ensured. However, safety is not guaranteed if the instrument has been treated inappropriately or carelessly.

If there is reason to believe that safe operation is no longer possible (e.g., if there is visible damage), the instrument must not be used, or if in use it must be taken out of service immediately.

Excessive voltages or currents or an incorrect cathode temperature can damage the tube irreparably.

- Keep within the specified operating parameters.
- Do not apply a heater voltage greater than 5 V.

When the tube is being operated, there may be dangerously high voltages in the area of the connections.

- Only use safety experiment leads for the connections.
- Only make connections when the voltage supply is switched off.

The instrument is not suitable for student experiments.

2. Description

The dual pole tube is used for demonstrating the Edison effect, for confirming the Richardson equation, and for measuring the current/voltage characteristic (I_A/U_A curve) of a diode.

The electrode system, consisting of a tungsten cathode and a cylindrical anode of sheet nickel, is housed in an evacuated glass bulb. The heating current for the tungsten cathode can be varied within the electron-emitting range. The anode connection is safe to handle and is mechanically fixed to the glass bulb.

The tube also incorporates another system (the getter), which serves to generate a high vacuum during the manufacture of the tube, and is not relevant to the functioning of the instrument.

3. Equipment supplied

1 Dual pole tube
1 Tube base with safety connection sockets
1 Instruction sheet

4. Technical data

Cathode area:	approx. 32 mm²
Max. anode voltage:	400 V
Heater voltage:	1.5 – 5 V
Heater current:	2 – 5 A
Tube dimensions:	approx. 120×45 mm²
Overall dimensions:	approx. 170x105x230mm³
Weight:	approx. 370 g

5. Operation

- Carefully push the tube into the two middle sockets of the base and connect the anode lead to one of the two red sockets, which are connected together internally.

The remaining socket (1) allows an external connection to the anode of the tube.

6. Sample experiments

For carrying out the experiments, the following additional equipment is needed:

1 DC power supply, 500 V (230 V, 50/60 Hz) U33000-230

or

1 DC power supply, 500 V (115 V, 50/60 Hz) U33000-115

1 Digital multimeter U118091

1 Electroscope U85321301

6.1 Demonstration of the Edison effect

In this reproduction of a historic experiment, the Edison effect is observed by means of an electroscope connected to the anode.

- Connect the circuit as shown in Fig. 1a/b.
- Transfer the positive charge of a rubbed glass rod to the anode and electroscope.

The charge remains present until the cathode of the tube is activated by heating. The electron deficit is then neutralised by the electrons emitted from the cathode. The anode becomes discharged.

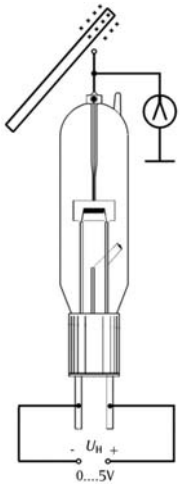


Fig. 1a Circuit set-up for demonstrating the Edison effect using an electroscope

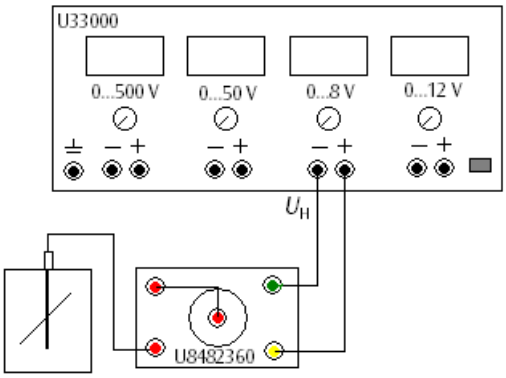


Fig. 1b Circuit connection of the 500 V DC power supply (U33000)

In a second experiment the effect is demonstrated using a multimeter.

- Connect the circuit as shown in Fig. 2a/b.

The multimeter shows a current of about 85 µA (the "Edison current"), as the tungsten filament at a high temperature emits electrons. Between the negative end of the heater coil and the anode there is a difference of +3 V, producing an electric field which accelerates the electrons so that they reach the anode.

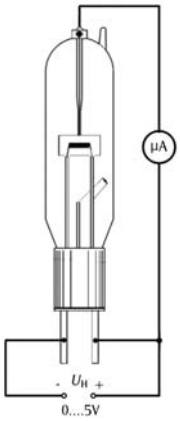


Fig. 2a Circuit set-up for demonstrating the Edison effect using a multimeter

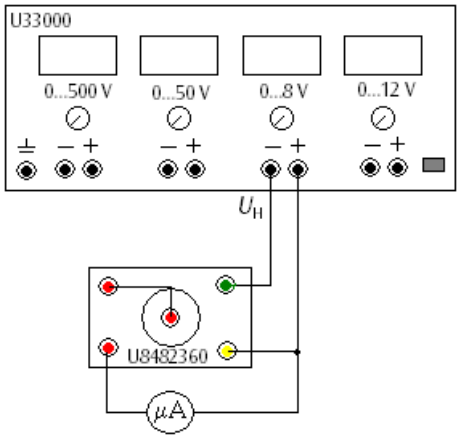


Fig. 2b Circuit connection of the 500 V DC power supply (U33000)

6.2 Measuring the current/voltage characteristic (I_A/U_A curve) of a diode

Figure 5 shows the different regions of a typical curve, which can be measured using two circuits.

The cutoff region (Sp) and the current onset region (A) are measured by applying a negative anode voltage, which is progressively reduced up to the beginning of the space-charge region (R). This part of the measurement ends with $U_A = 0$ V.

- For the latter regions, connect the circuit as shown in Figures 3a/b.
- Determine how the anode current I_A depends on the anode voltage U_A by decreasing the anode voltage step by step from -8 V to 0 V.
- Plot the values of I_A and U_A on a graph.

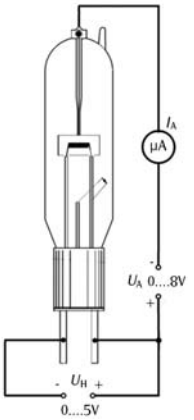


Fig. 3a Circuit set-up for measuring the current onset region

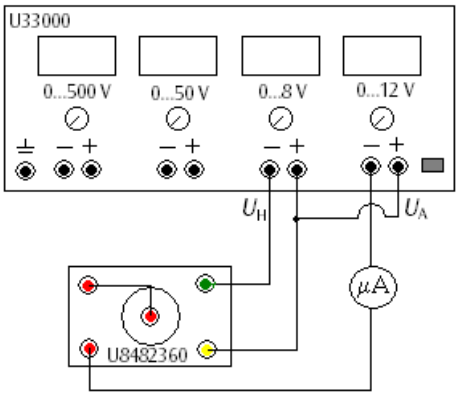


Fig. 3b Circuit connection of the 500 V DC power supply (U33000)

The space-charge region (R) and the saturation region (S) of the curve are measured by applying a positive anode voltage that is varied over the range 0…250 V.

- Connect the circuit as shown in Figures 4a/b.
- Determine how the anode current I_A depends on the anode voltage U_A by raising the anode voltage step by step from 0 V to 250 V.
- Plot the values of I_A and U_A on a graph.

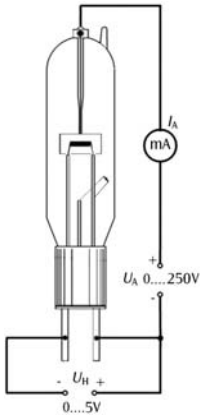


Fig. 4a Circuit set-up for measuring the space-charge and saturation regions

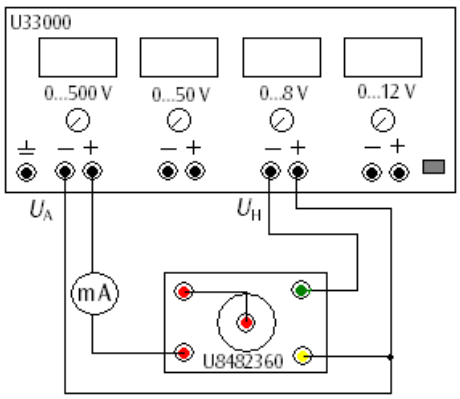


Fig. 4b Circuit connection of the 500 V DC power supply (U33000))

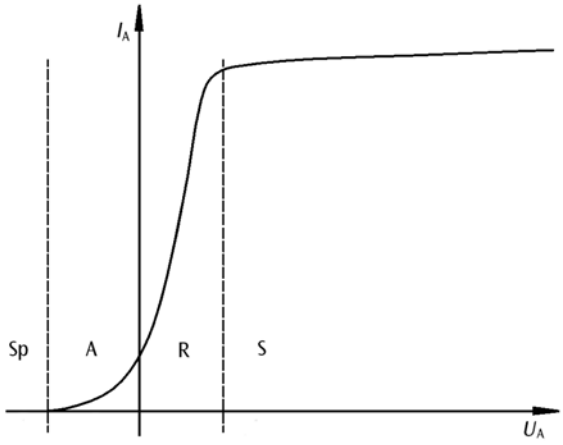


Fig. 5 Current/voltage characteristic of a diode