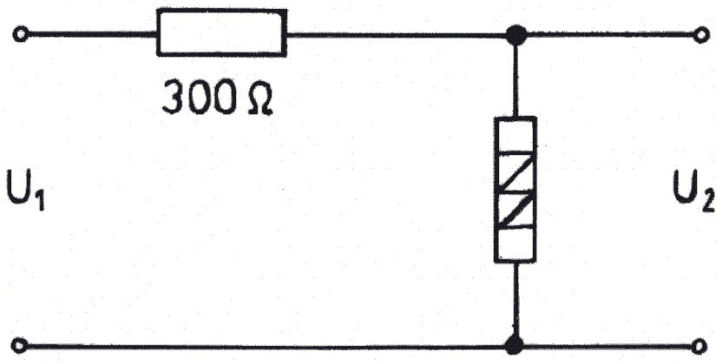
Experimental problem: "Semiconductor element"

In this experiment a semiconductor element (—□/⁄/□—), an adjustable resistor (up to 140 Ω), a fixed resistor (300 Ω), a 9-V-direct voltage source, cables and two multimeters are at disposal. It is not allowed to use the multimeters as ohmmeters.

a) Determine the current-voltage-characteristics of the semiconductor element taking into account the fact that the maximum load permitted is 250 mW. Write down your data in tabular form and plot your data. Before your measurements consider how an overload of the semiconductor element can surely be avoided and note down your thoughts. Sketch the circuit diagram of the chosen setup and discuss the systematic errors of the circuit.

b) Calculate the resistance (dynamic resistance) of the semiconductor element for a current of 25 mA.

c) Determine the dependence of output voltage U_2 from the input voltage U_1 by using the circuit described below. Write down your data in tabular form and plot your data.



The input voltage U_1 varies between 0 V and 9 V. The semiconductor element is to be placed in the circuit in such a manner, that U_2 is as high as possible. Describe the entire circuit diagram in the protocol and discuss the results of the measurements.

d) How does the output voltage U_2 change, when the input voltage is raised from 7 V to 9 V? Explain qualitatively the ratio $\Delta U_1 / \Delta U_2$.

e) What type of semiconductor element is used in the experiment? What is a practical application of the circuit shown above?

Hints: The multimeters can be used as voltmeter or as ammeter. The precision class of these instruments is 2.5% and they have the following features:

measuring range	50 μA	300 μA	3 mA	30 mA	300 mA	0,3 V	1 V	3 V	10 V
internal resistance	2 kΩ	1 kΩ	100 Ω	10 Ω	1 Ω	6 kΩ	20 kΩ	60 kΩ	200 kΩ