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KAR

MEASURE OF A RECTIFIER CIRCUIT

Measurement practice I.

FOR VEHICLE ENGINEER STUDENTS

Version: 1.0

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1. Introduction

This measurement exercise examines a half-wave diode rectifier circuit with resistive load. The circuit is used to rectify an alternating (sinusoidal) signal, i.e. to convert an alternating current into a direct current (AC to DC). The half-wave type is the simplest version of the circuit passing either the negative or positive half-cycle of the waveform and blocking the other. The measurement exercise will also discuss the function of the output filter capacitor. Accordingly, two circuits are investigated and measured: the first is a half-wave rectifying circuit without an output filter capacitor, and the second is the same circuit with an output filter capacitor.

1.1 Objectives

- Characterization of diode behavior;
- Study of capacitor behavior.

1.2 Required instruments and components

- sine wave generator (see Fig. 1.);
- resistor table (see Fig. 2.);
- semiconductor table (see Fig. 3.);
- capacitor table (see Fig. 4);
- digital oscilloscope (see Fig. 5);
- measuring cables (to the oscilloscope and signal generator).

Fig.1. Signal generator

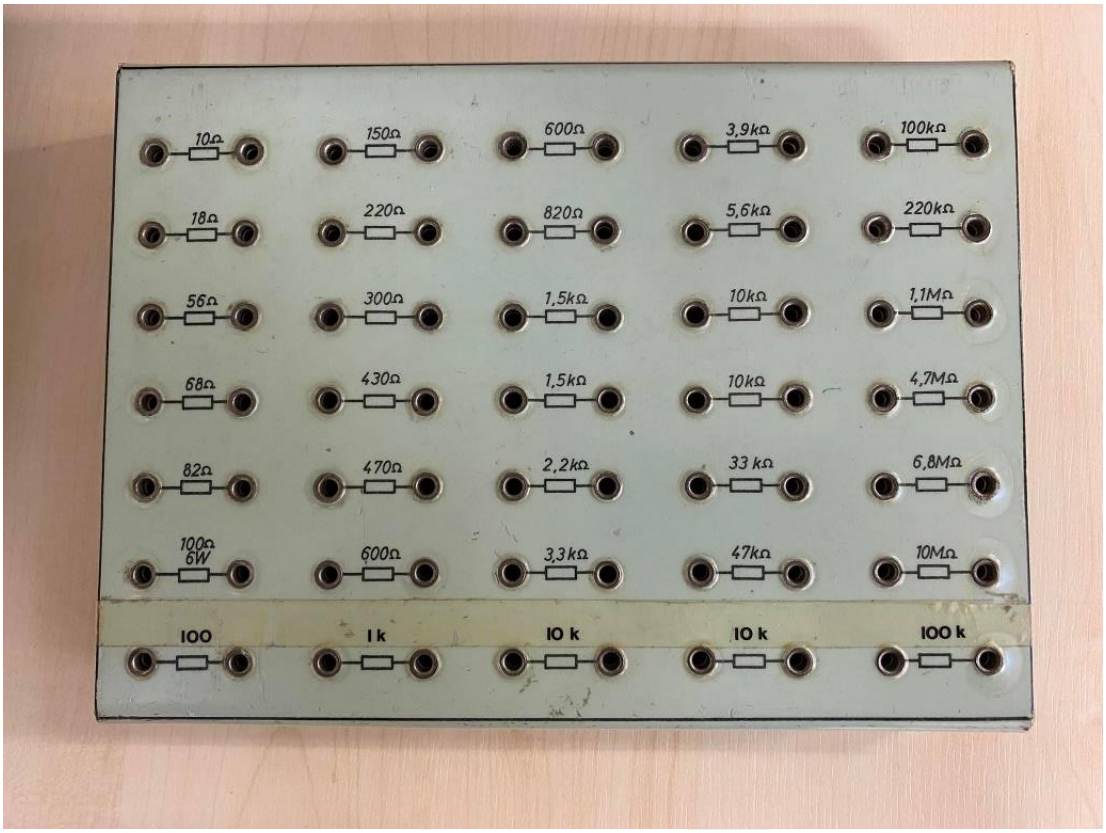


Fig.2. Resistor table

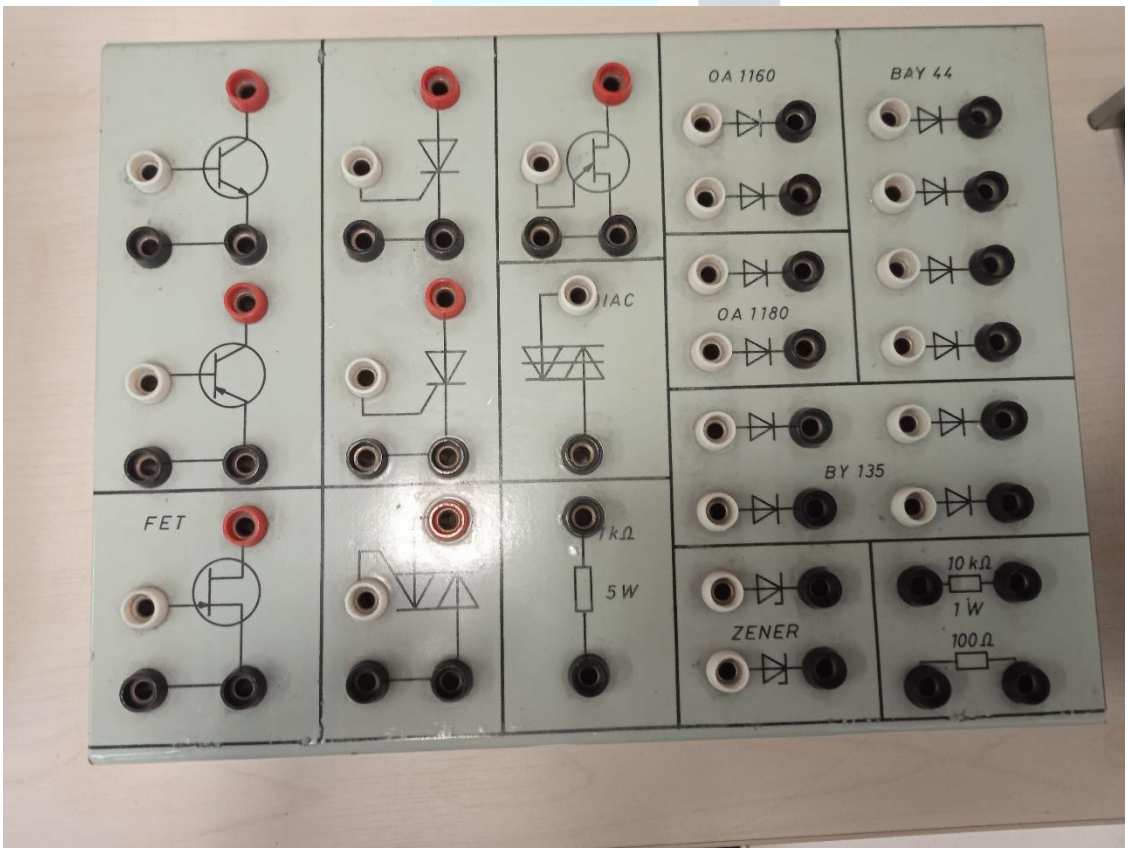


Fig.3. Semiconductor table

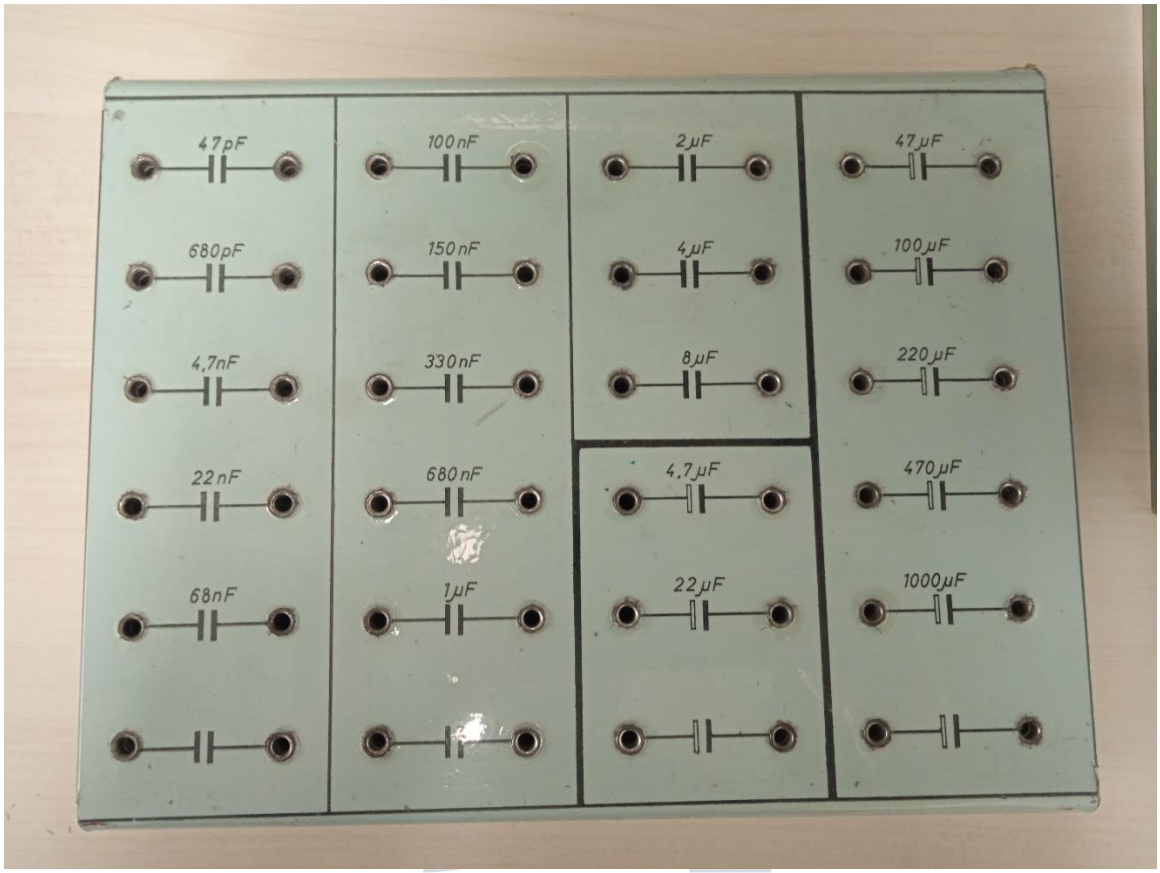


Fig.3. Capacitor table

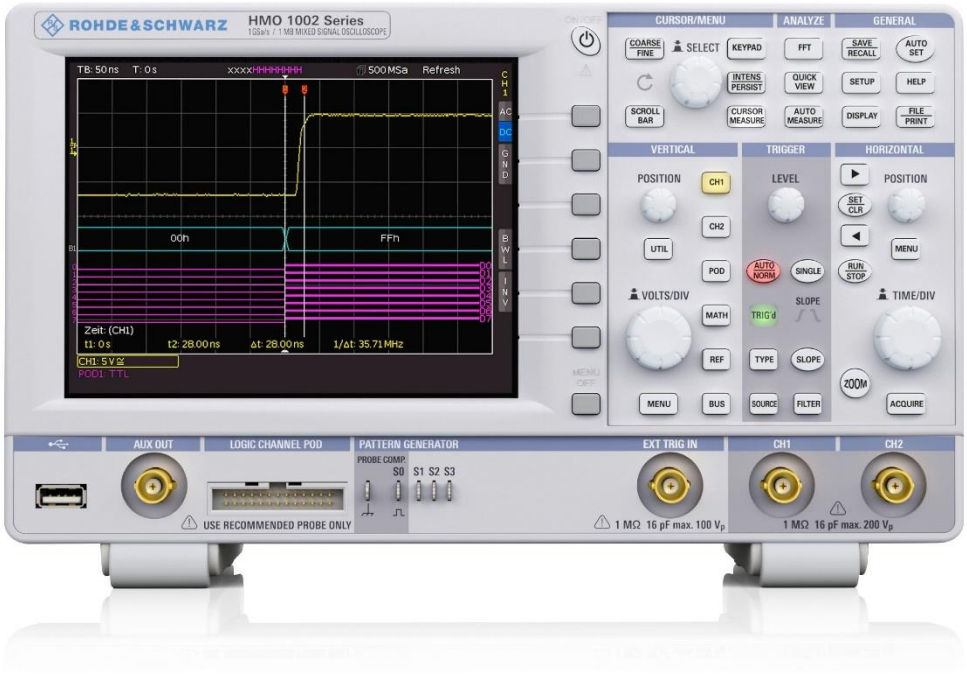


Fig.5. Digital oscilloscope

3. Measurement exercises, wiring diagrams

3.1 Rectifier circuit without filter capacitor

The rectifier circuit diagram is shown in Fig.6. During the measurement, the diode, and the load (resistor) are connected in series. The first channel of the oscilloscope measures the input (dc) voltage, and the second channel measures the voltage across the resistor (output).

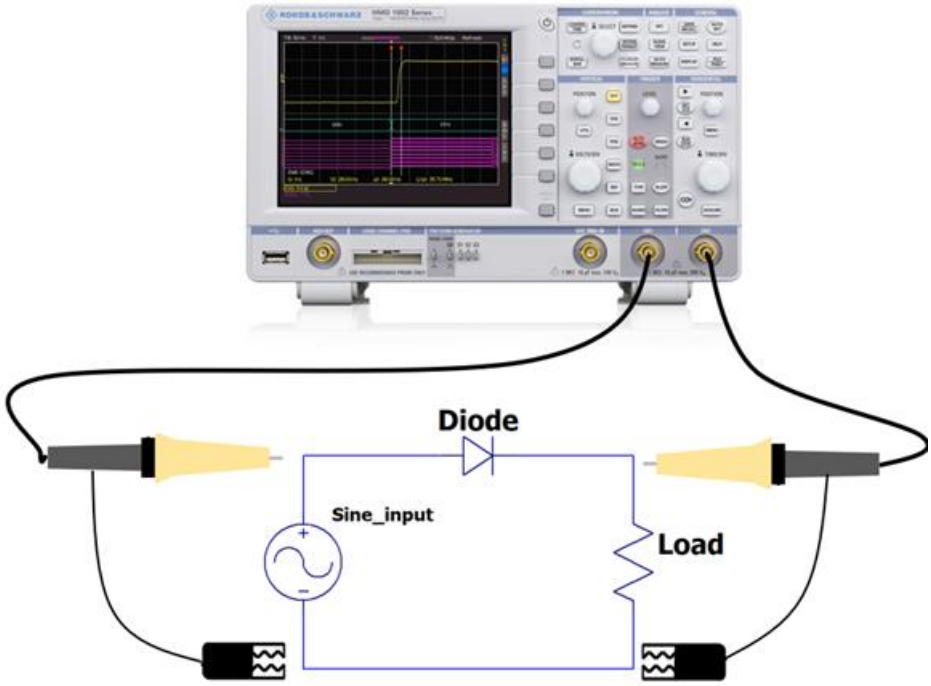


Fig.6. First measurement circuit (half-wave rectifier without output filter capacitor)

The steps of measurement:

1. Prepare the necessary tools and instruments.
2. Set up the AC signal generator to produce a 20V, peak-to-peak (pp) 1kHz signal. Check the set value using an oscilloscope.
3. Build the circuit (Use diode **BY135** and resistor **R=1.5kOhm** for this!)!
4. Connect the oscilloscope as shown in the diagram!
5. Connect the signal generator to the circuit.
6. Draw the output waveform (both channels of the oscilloscope). Record the oscilloscope settings (Volt/Div; Time/Div)!

3.2 Rectifier circuit with filter capacitor at the output

The circuit diagram for the measurement is shown in Figure 7. The measurement is very similar to the first measurement exercise.

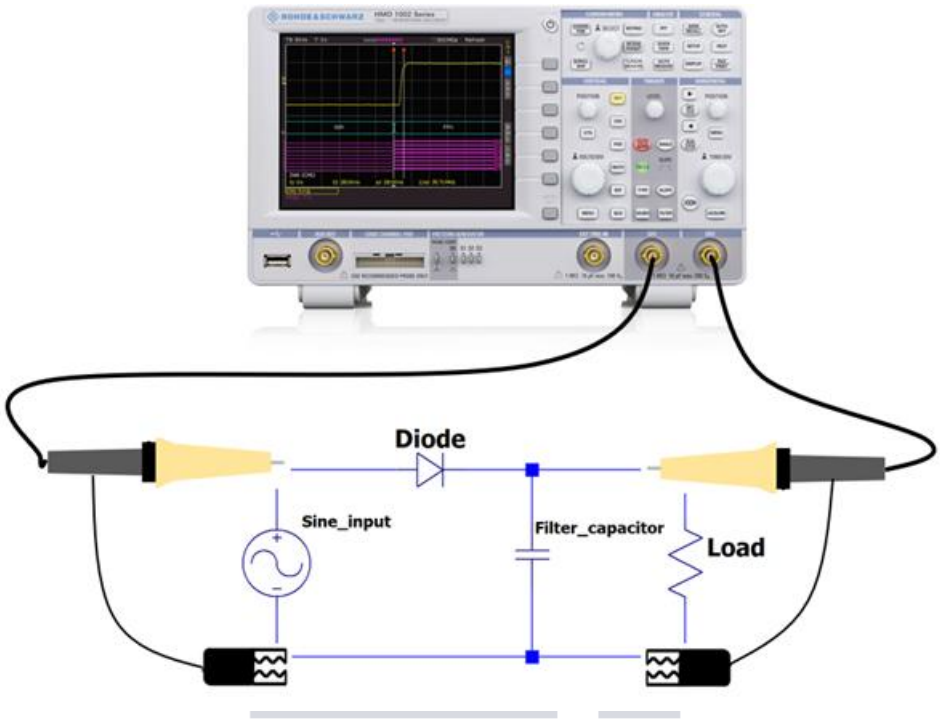


Fig.7. Second measurement circuit (half-wave rectifier with output filter capacitor)

The steps of measurement:

1. Prepare the necessary tools and instruments.
2. Set up the AC signal generator to produce a 20V, peak-to-peak (pp) 1kHz signal. Check the set value using an oscilloscope.
3. Build the circuit (Use diode **BY135** and resistor **R=1.5kOhm** and firstly **C=1µF** capacitor for this!)!
4. Connect the oscilloscope as shown in the diagram!
5. Connect the signal generator to the circuit.
6. Draw the output waveform (both channels of the oscilloscope). Record the oscilloscope settings (Volt/Div; Time/Div)!

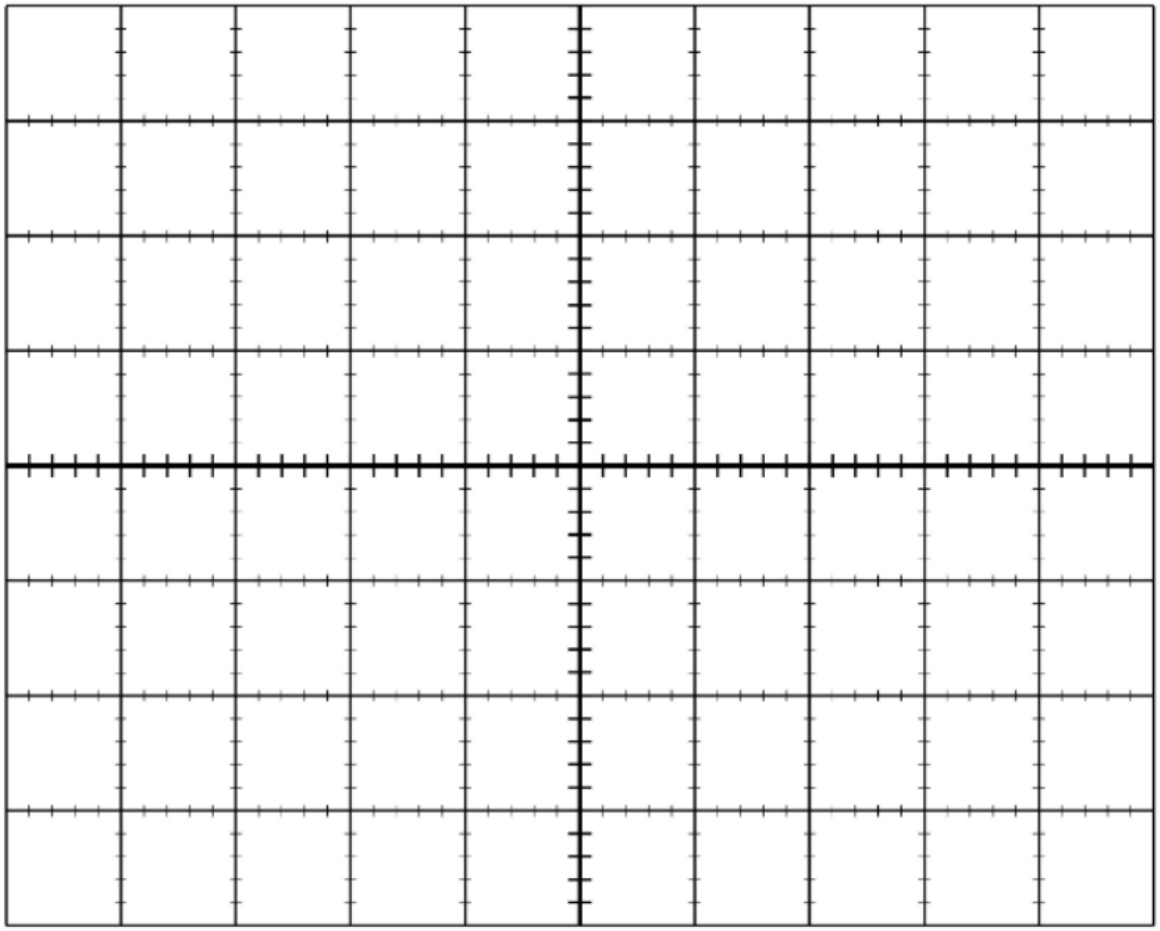
Repeat the measurement using a capacitor with a higher value **(C = 4.7µF)**!

4. Conclusions

Why is the diode only conducted in the first half period?
Why does the diode not conduct in the second half period?
What is the difference if a capacitor is used at the output for filtering?
How does the output voltage depend on the size of the capacitor?

5. Measurement results

The output waveform of the first measurement:
Volt/Div:
Time/Div:



The output waveform of the second measurement:
Volt/Div:
Time/Div: