LAB 4: DC POWER SUPPLY CIRCUIT

1. Goals

- Understand the working principles of the bridge rectifier.
- Know the usage of the LM317 voltage regulator.
- Know how to implement a DC power supply circuit.

2. Exercises

Exercise 1. Implement a stable DC power supply circuit, which consists of a voltage transformer, a bridge rectifier (KBP307), capacitors, resistors/variable resistors, a voltage regulator (LM317), as shown in Figure 1.

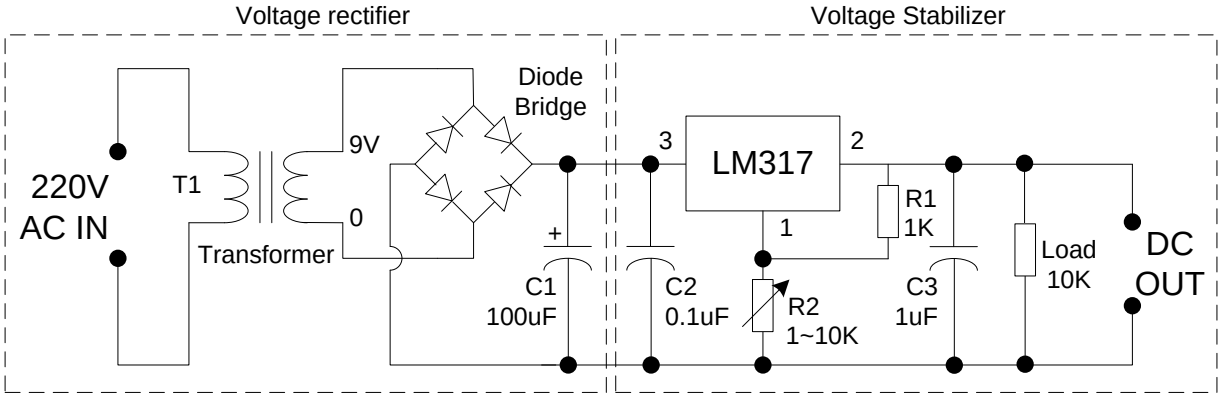


Figure 1. Stable DC supply power schematic using LM317 and KBP307.

Requirements:

a) Follow the steps below to implement the voltage rectifier:

- Assemble a circuit that consists of a transformer with the primary voltage of 220V AC and the secondary voltage of 9V AC (effective voltage) on a breadboard. Use an oscilloscope to display the waveform of the secondary voltage. Record and explain the experimental results.
- Assemble the bridge rectifier (KBP307) on the same breadboard. The input of the bridge rectifier is the secondary voltage of the transformer (i.e., 9V AC). Use the oscilloscope to display the waveform of the output voltage of the bridge rectifier. Record and explain the experimental results.
- Add a capacitor (0.1µF, 10µF, and 100µF) to the output voltage of the bridge rectifier (see C1 in Figure 2). Use an oscilloscope to display the waveform of the output voltage of the bridge rectifier. Record the experimental results and explain the role of the capacitor. ***Note: You must carefully assemble the polarized capacitor.***

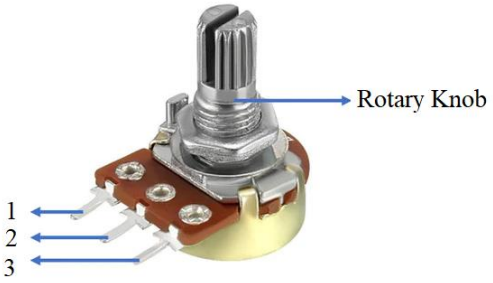
b) Follow the steps below to implement a stable DC power supply circuit:

- Assemble the voltage stabilizer on the same breadboard of the voltage rectifier. The input of the voltage stabilizer is the output voltage of the voltage rectifier. Use the oscilloscope to display the waveform of the DC output voltage. Record and explain the experimental results.
- Select the values of R1 and R2 such that $\frac{R2}{R1} = 1$, $\frac{R2}{R1} = 2$, $\frac{R2}{R1} = 3$, $\frac{R2}{R1} = 4$, respectively. For each $\frac{R2}{R1}$, use a multimeter the measure the DC output voltage. Record and explain the experimental results. Compare the experimental results with the theoretical calculation.
- Select the values of R1 and R2 such that $\frac{R2}{R1} > 5$ and then use the multimeter to measure the DC output voltage. Record and explain the experimental results. Compare the experimental results with the theoretical calculation.

Components and devices needed for the lab:

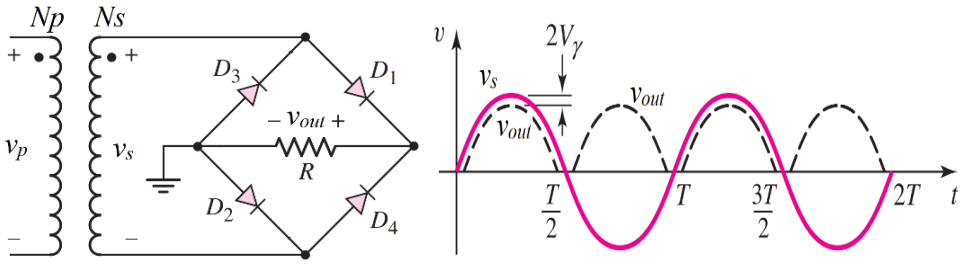
Components & Devices	**Description**	**Amount**
Capacitor	0.1 µF / 10 µF / 100 µF	1/1/1
Resistor	1 kΩ / 10 kΩ	1/1
Variable resistor	1 kΩ ~ 10 kΩ, WH148 datasheet	1
Transformer	3A, 3V ~ 24VAC	1
Diode or Bridge rectifier	1N4007 hoặc KBP307 datasheet	4/1
IC regulator	LM317 datasheet	1
Breadboard		1
Wires		Few
Oscilloscope		1
Multimeter		1

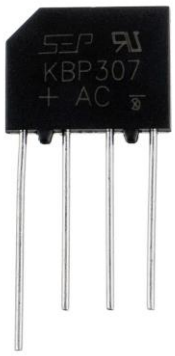
Variable resistor (WH148):



Read the datasheet of WH148 for more details.

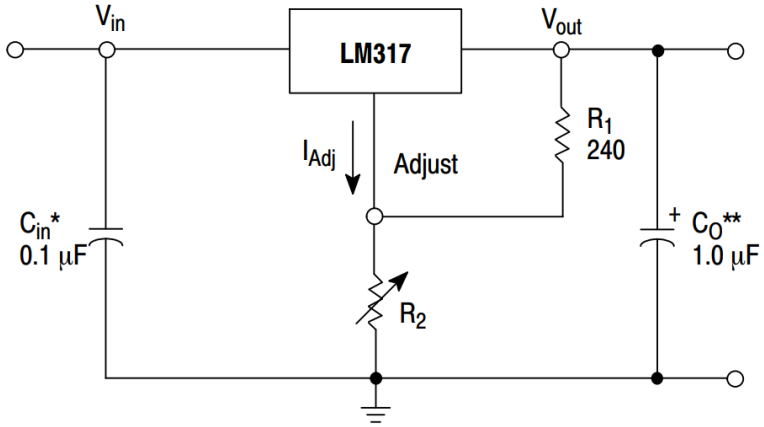
Bridge rectifier (KBP 307):

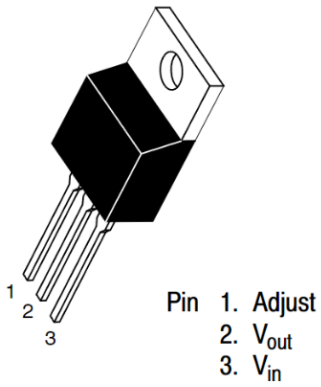




Read the datasheet of KBP 307 for more details.

Voltage regulator (LM 317):





The output voltage of the regulator is calculated by: $\boldsymbol{V_{out} = 1.25 \times \left(1 + \frac{R2}{R1}\right) + I_{ADJ}R_2}$, where $I_{ADJ} \approx 50\mu A$ (can be omitted). Read the datasheet of LM317 for more details.