THE NPN-TRANSISTOR AS A SWITCH LAB A4

1. TASK

An LED should be switched on and off electrically without the use of a mechanical switch.

2. SOLUTION APPROACH

The switching process can be controlled via a so called NPN transistor.

3. EXPERIMENT DESCRIPTION

In order to limit the base current and not to destroy the transistor a base resistor R2 is used. In the output circuit of T there is a LED with resistor R3, so that the current through the LED is not too large. This resistor is already mounted on the PSITRON LED module and doesn't need to be added on the board again.

Lab A4.1: The two contacts K1 and K2 are not connected.

Lab A4.2: Touch the two contacts K1 and K2 e.g. with two lightly moistened fingers.

Lab A4.3: The two contacts are bridged with a magnetic wire.

4. OBSERVATION

Lab A4.1: With open contacts K1 and K2 there is no voltage at R1 and R2. The multimeter displays 0V. As a result no base current flows and thus no collector current. The LED does not light up. (Switch is OFF)

Lab A4.2: The result is a voltage divider between K1 / K2 and R1. The voltage drop across R1 is sufficient to produce a base current in the base-emitter circuit of T. The voltage UBE measured with the multimeter is approx. 0.6V depending on the skin resistance. As the transistor amplifies currents, a larger base current flows in the collector circuit (= base current multiplied by amplification factor of the transistor). The LED lights up as the internal resistance of T has already dropped so far that a sufficient collector current flows.

Lab A4.3: If we connect the two magnetic contacts with a magnetic wire then R1 is at full operating voltage. R2 and the base-emitter diode of T form a voltage divider. At the base-emitter diode a voltage drop of about 0.7V can be measured. The LED lights up quite strong as the max. possible collector current flows. (Switch is ON)

LEARNING SUCCESS

The transistor can be used as an amplifier. A small base current results in a large collector current. And small changes in the base current will cause large changes in the collector current.

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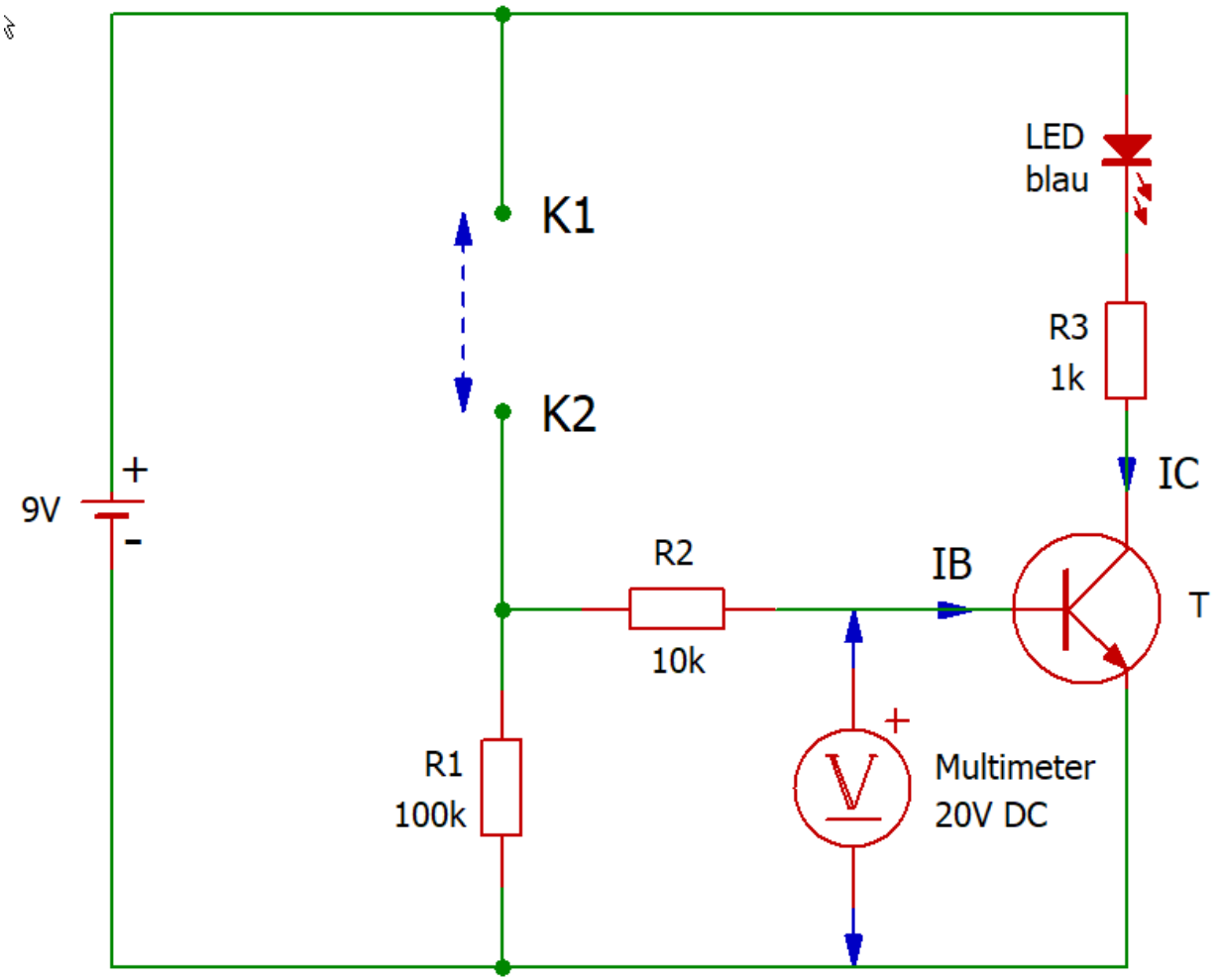

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