

LAB 1: TRANSISTOR DRIVER CIRCUITS

ET255 DIGITAL ELECTRONICS 1

Don Wilcher

LAB REPORT 1: TRANSISTOR DRIVER CIRCUITS

OBJECTIVE:

This laboratory project was developed to illustrate several key elements associated with using bipolar transistors as electronic switches:

1. Transistors having sufficient h_{fe} can be used to drive small current based LEDs (Light Emitting Diodes).
2. Transistors can be used as Low Side switches for providing a controllable return path (ground) for the connected electromechanical or solid state component.
3. To drive higher current carrying devices like solenoids, motor, and lamps, an electromechanical relay along with a transistor can be used for low current control (switching).

BILL OF MATERIALS (BOM):

The following electronic parts were used to investigate the basic transistor driver circuits.

- (1) 10K Ω resistors
- (1) 1K Ω resistor, 100 Ω resistor
- (1) 2N3904 NPN Transistor
- (1) 330 Ω or 470 Ω resistor
- (1) LED
- (1) SPDT (Single Pole-Double Throw) electrical switch
- (1) 5VDC Electromechanical Relay and a small dc motor

CIRCUIT ASSEMBLY AND TEST PROCEDURE:

1. A small SPDT (Single Pole Double Throw) switch was wired as shown in **Figure 1**.

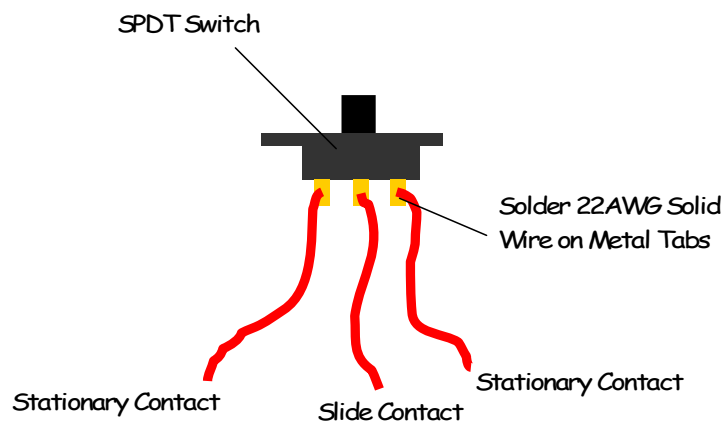


Figure 1. Attaching 3 wires to a SPDT Switch

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- Using the circuit schematic diagram shown on **Figure 2** the SPDT switch along with the other electronic components was wired onto a solderless breadboard.

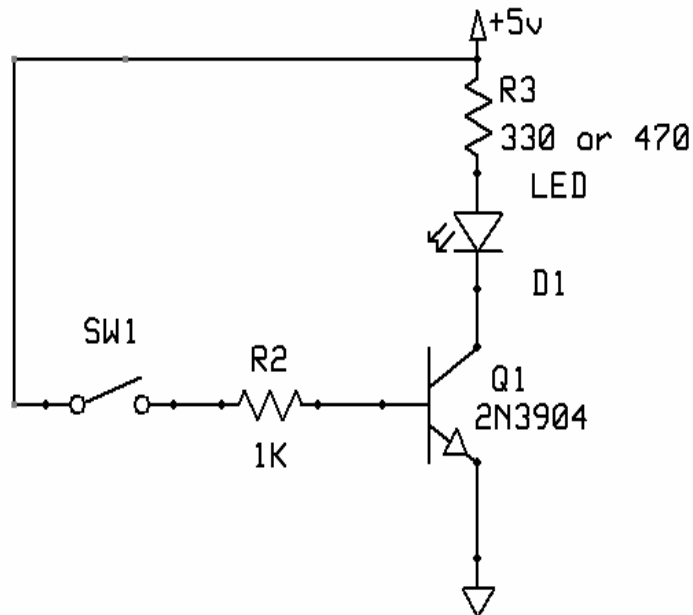


Figure 2. Transistor-LED Driver Circuit

- The +5VDC from the Laboratory Power Supply was used to energize the circuit.
- To test the circuit shown in Figure 2, the SPDT switch was toggle back/forth or up/down depending on component orientation. The LED should have turned ON & OFF based on the “toggling” of the SPDT switch.
- If the circuit was not working correctly, the DC Power Supply was turned off and the wiring rechecked for mistakes.
- Steps 4-5 were repeated.
- Small 22AWG (American Wire Gauge) wires were soldered to the terminals of the dc motor as shown in **Figure 3**.

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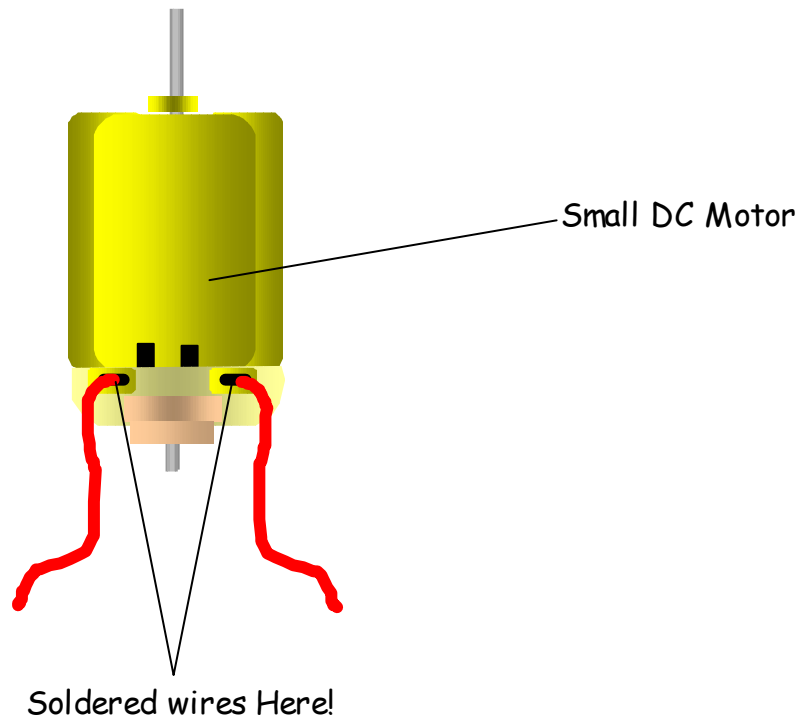
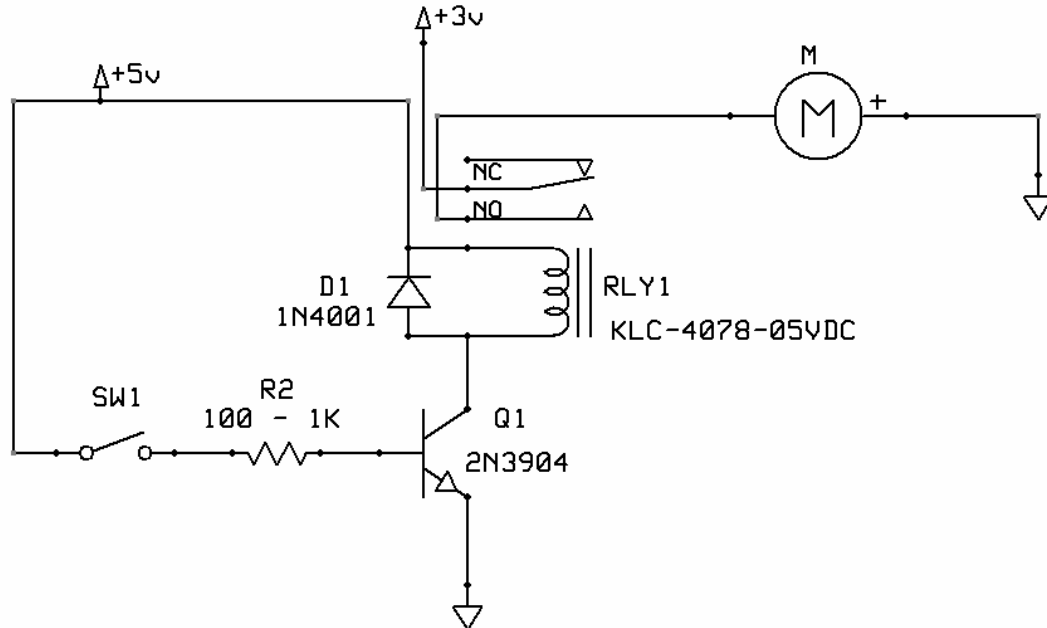


Figure 3. Attaching wires to the Small DC Motor

8. The circuit in **Figure 4** was wired. The LED was replaced with the 5VDC Relay on the solderless breadboard.
9. The Laboratory DC Power Supply was turned ON and the output was adjusted to +3VDC using a DMM.
10. The Positive and Negative Test Leads of the Laboratory DC Power Supply were applied to the Transistor Relay Driver circuit built in Step 8.
11. The Laboratory DC Power Supply was turned on for testing the new electronics driver.
12. To test the circuit shown in **Figure 4**, the SPDT switch was toggle back/forth or up/down depending on component orientation. The small dc motor should have turned ON & OFF based on the "toggling" of the SPDT switch.

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13. If the circuit was not working correctly, the DC Power Supply was turned off and the wiring rechecked for mistakes.
14. Steps 12-13 were repeated.



CONCLUSION:

The 2 transistor driver circuits worked as outlined in the Circuit Assembly and Test Procedure of the Lab Project Handout. There were no problems in assembling the circuits and the Laboratory DC Power Supply Fixed+5V source was used in the testing of each electronic driver. For this project a simple SPST (Single Pole Single Throw) switch could have easily been used as the input control device. Although the SPDT switch was used to control both transistor driver circuits, a basic logic gate can also be used as a small digital controller interface. Also, the motor can easily be replaced with a solenoid provided the relay contacts' has the appropriate current rating.