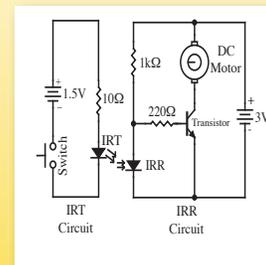
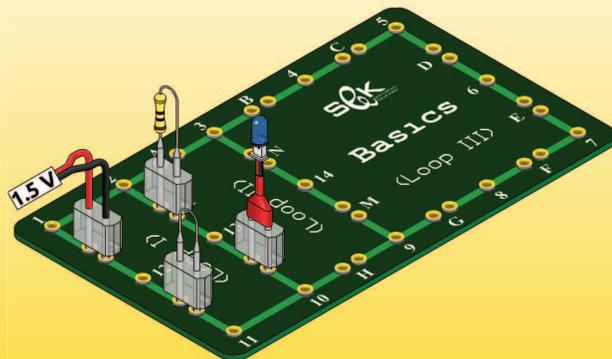


## Experiment No. (35)

## Using the Transistor as a Switch (Infra Red Remote Control)



### Objectives:

1. The student will set up a switching circuit using a transistor, IR receiver diode and IR transmitter diode.
2. The student will set up an IR sensor using transistor, IR receiver and IR transmitter diodes.

### Apparatus:

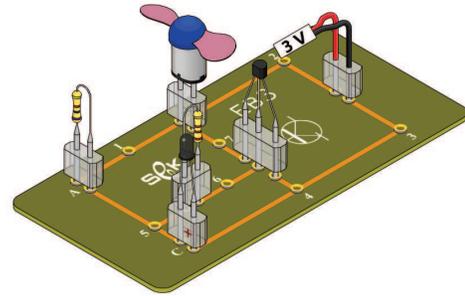
- Basics Board
- EB3 Board
- Connection Wires
- Voltage Source (PSB Board)
- Resistor 1K $\Omega$
- Resistor 220 $\Omega$
- Resistor 10 $\Omega$
- Electric Motor
- Transistor
- DMM
- Buzzer
- IRR
- IRT

### Procedure and Conclusions:

1. Use Loop I on the Basics Board to set up an infrared transmitter circuit by inserting a resistor 10 $\Omega$  at the pair (K), IRT diode at the pair (L) in a way that its positive terminal will be towards the point (13), and a jumper at the pair (I).
2. Connect (1.5 volt) from PSB Board to the pair (J) using a connection wire in a way that the positive terminal (red wire) will be towards the point (1).
3. Use EB3 Board to set up an infrared transmitter circuit by inserting the transistor at (F) in a way that the collector will be towards point (7), a resistor 220 $\Omega$  at the pair (D), a resistor 1K $\Omega$  at the pair (A), IRR diode at the pair (C) in a way that its positive terminal will be towards the point (5), and insert an electric motor at the pair (E).

4. Use another connection wire to connect (3 volt) from the PSB board to the pair (B) in a way that the positive terminal (red wire) will be towards the point (2).

See what happens to the electric motor.



5. Turn the selection dial of the DMM to DCV mode (range 20 V), insert its probes at the points (4) and (6) to measure the voltage difference between the base and the emitter of the transistor. Record the voltmeter reading.
  - The voltage difference between the base and the emitter of the transistor is ..... volt.
6. Point IRT vertically and closely to the IRR, see what happens to the electric motor, record Voltmeter reading.
  - The voltage difference between the base and the emitter of the transistor becomes ..... volt.
7. Pass your hand between the IRT and IRR diodes to cut the IR radiations and watch what happens to the electric motor.
  - In the above circuit, the transistor turns ... ON / OFF ... when the IRR diode detects IR radiation from the IRT diode, since the reverse resistance of the IRR becomes ... larger / smaller ..., and hence the voltage difference between the base and the emitter is ... less / greater ... than the forward-bias voltage of the transistor.
  - When we point the IRT vertically and closely to the IRR the electric motor ... rotates / stands still ..., this indicates that the transistor turns ... ON / OFF ...
8. Insert the buzzer at the pair (E) instead of the electric motor in a way that its positive terminal will be towards the point (7). Repeat steps 6 to 9.
9. Swap IRR and resistor  $1K\Omega$  places on the EB3 Board by inserting the resistor  $1K\Omega$  at the pair (C) and the IRR at the pair (A) in a way that its negative terminal will be towards the point (5).
10. Point the IRT vertically and closely to the IRR, see what happens to the buzzer. Record Voltmeter reading (voltage between base and emitter).
  - In this circuit, when the IRR detects IR radiation from the IRT the buzzer ... will / will not ... buzz because the voltage between base and emitter becomes greater than the forward-bias voltage of the transistor, and hence the collector current increases enough to make the buzzer buzzes.