

## Experiment 6-

### Opto Transmitter

In this experiment you will build an opto (optical) transmitter that uses a LED to emit a pulse modulated light beam. The 555 IC (IC1) is used to generate the audio pulses which modulates the light. The LED used in this experiment emits a beam of light within the visible spectrum. The receiver built in the previous experiment (experiment 5), will be used to detect and process (amplify) the information modulated in the light beam.

The schematic diagram of this experiment is shown in figure 1. In this circuit we use the 555 IC timer, working as a clock, to generate audio pulses. The frequency of the pulses is controlled by the values of R1, P1, R2, and C1, and it can be adjusted with potentiometer P1. The larger these values, the lower the frequency of the pulses, and viceversa. Capacitor C2 is connected between pin 5 and negative to add frequency stability to the circuit. The output of the 555 IC, pin 3, is connected through resistor R3 to the LED, which will light up with every pulse produced by IC1. You will not be able to see the LED blinking with the pulses, as their frequency is high, (between 200Hz and 5KHz approximately). Instead, you will see a steady light beam.

#### **Procedure:**

- Assemble the circuit of this experiment according to figures 1 and 2. Be sure to install the IC, and the flat side of the LED in the correct direction, as shown in figure 2. When done, verify that the assembly is correct and install a fresh 9V battery to the snap.

- Take the breadboard with the opto receiver that you assembled in experiment 5. Connect a fresh 9V battery to the snap on it.

- Align both boards in such manner that the LED of the transmitter (experiment 6) is facing the phototransistor of the receiver (experiment 5). Insert the LED and the phototransistor in the supplied tubing, as shown in figure 3. As you do this, you will hear a tone, produced by the transmitter and carried in the light beam, reproduced by the speaker of the receiver. Adjust potentiometer P1 to vary the frequency of the tone.

- Remove the tubing and observe the circuit operation through open air, as shown in figure 4. Interrupt the light beam with a piece of paper and observe how the transmission stops. Remove the paper and separate the transmitter and receiver and observe how the intensity of the audio signal decreases with the distance.

**Note:** After completing this experiment do not disassemble any of the boards as you need both completed boards for experiment 7.

#### **Parts List:**

**R1:** 4.7K $\Omega$  Resistor (Yellow, Violet, Red)

**R2:** 1K $\Omega$  Resistor (Brown, Black, Red)

**R3:** 100 $\Omega$  Resistor (Brown, Black, Brown)

**P1:** 50K $\Omega$  Potentiometer

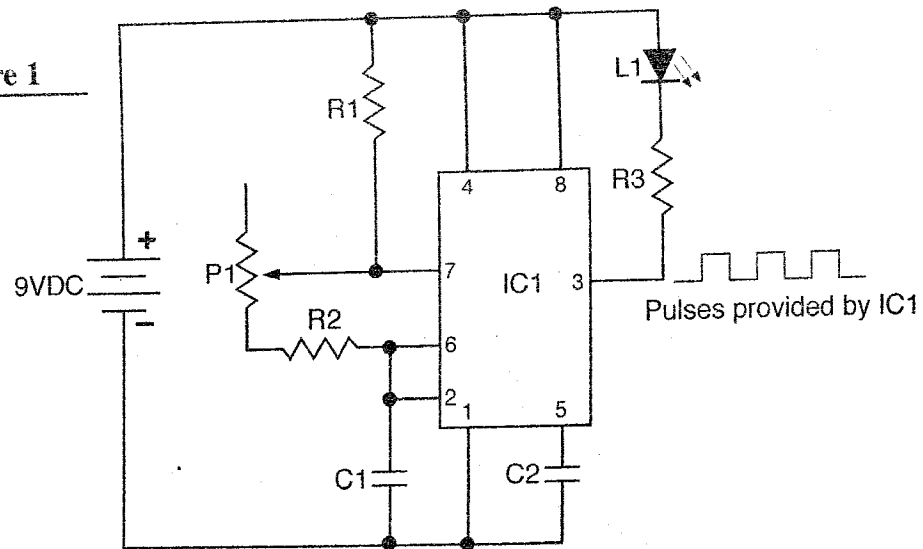
**C1:** .1 $\mu$ F Disc Capacitor (104)

**C2:** .01 $\mu$ F Disc Capacitor (103)

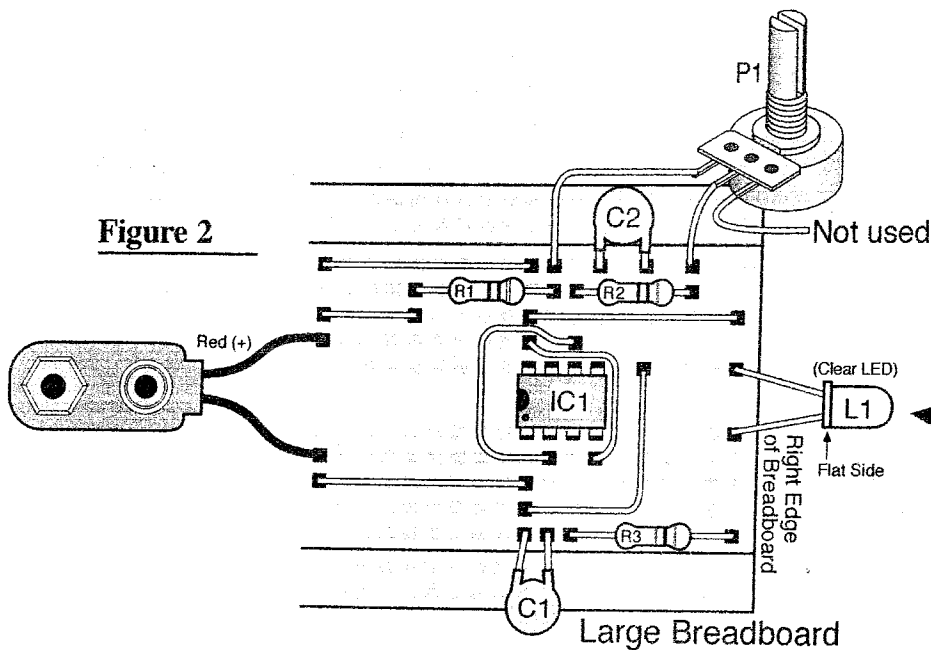
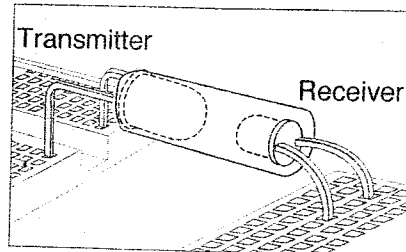
**IC1:** 555 IC

**L1:** Clear LED with mark on the case

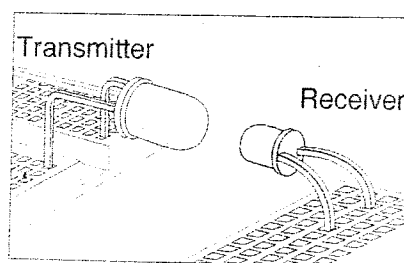
**Misc:** Battery snap, breadboard, wires, piece of plastic tube, and assembled experiment 5.

**Figure 1**

**IMPORTANT NOTE:** Build this project so that the LED extends over the end of the protoboard as shown below.

**Figure 2****Transmitter****Figure 3**

Use the supplied tubing to align the transmitter (Exp. 6) and receiver (Exp. 5) circuits.

**Transmitter****Figure 4**

Remove tubing and observe circuit operation through open air.