

# Oscillators and Timers

## Equipment

- Protoboard Workstation
- Digital Oscilloscope

## Objective

Understand operation of oscillators

- RC relaxation

Understand operation of 555 Timer IC

- Astable operation
- Monostable operation

## Conceptual (C-level)

Read chapter 9 in your text.

Draw a diagram of a RC relaxation oscillator.

- Analyze the circuit.
- What voltage needs to be applied to  $V_I$  to operate this circuit?
- Why is positive feedback used?
- Choose resistors and a capacitor so that  $V_T$  is 1.5 volts and the frequency is 1kHz.

Draw a diagram of a 555 Timer. Label and describe the inputs.

Draw a diagram of the lamp flasher circuit (see figure 9.13)

- Analyze the circuit.
- Draw a  $V(t)$  graph of the voltage across the lamp (i.e. how fast does the lamp flash?)

## Basic Lab (B-level)

Construct a RC relaxation oscillator (see figure 9.2)

- Verify your circuit - quantify the output for your chosen RC value

Construct a square and triangle wave oscillator (see figure 9.4)

- Verify your circuit - quantify the output
- Determine the frequency range you can obtain with this circuit

Construct a basic astable oscillator (see figure 9.7) with  $t_{low} = 1$  msec and  $t_{high} = 10$  msec

- Verify your circuit - quantify the output
- Change the oscillator to a low duty cycle oscillator

Construct either a metronome or LED flasher (see figure 9.13)

- Verify your circuit - quantify the output

## Advanced/Extended Lab (A-level)

- Design and construct a siren. Note: use one 555 Timer to pulse another 555 Timer to modulate the sound.
- Design and construct a basic crystal oscillator.

Substitutions may be considered.