

Robotics and Communication Systems Engineering Technology

Lab Experiment 5

SWITCHING TRANSISTORS AND TIMEING CIRCUITS

OBJECTIVE

After the completion of this unit, the student should be able to compute component values, voltages, and currents for transistors used in the switching mode. The student should be able to measure and record the voltages and waveforms for a transistor astable multi vibrator, mono-stable multi vibrator, and bi-stable multi vibrator. Connect a 555 timer chip in astable and mono-stable mode, and calculate and operate the 74121 IC.

REFERENCES

1. Theory notes

EQUIPMENT & MATERIALS

1. Oscilloscope
2. Pulse generator
3. 2N3904
4. Power supply
5. DVM
6. Misc. Resistor & Capacitors and diodes

SPECIFIC OBJECTIVES

****Draw complete schematics for all circuits.**

1. Define: delay time, rise time, turn on time, turn off time, storage time, and fall time. Describe with drawings.
2. Look up and record in your lab book the specs for a 2N3904 transistor delay time, rise time, storage time, fall time, turn on time, turn off time.
 - a. Design and calculate a switching circuit using a 2N3904 transistor and measure all switching times and compare them to the specs.
 - b. Calculate for, and add a commutating capacitor to the switching circuit and measure all switching times and compare them to the specs.

3. Design and calculate an astable multivibrator to produce a PRF of _____ and duty cycle of 50%. Draw the predicted waveforms and label voltage and times.
 - a. Build and measure the astable you designed and draw the measured waveforms and label voltage and times. (One potentiometer may be used if needed.)
 - b. Add a diode to the astable for rise time improvement. Show the calculations for the pulse width and pulse spacing and measure and draw the output waveforms.
 - c. Set your generator on your bench to the same frequency as your astable multivibrator circuit that you built and sync them together. **Verify your working circuit with your instructor (1).**

4. Disconnect the generator, and differentiate the output of your astable circuit above to make a trigger. Design and calculate a monostable circuit, and draw the waveforms showing the output of your astable, the output of your differentiator, and the output of your monostable with voltage and times. Design your monostable multivibrator to produce a pulse width of _____ for every input trigger.
 - a. Construct, measure and draw the waveforms from the output of your astable, output of your differentiator and the output of the monostable. **Verify your working circuit with your instructor (2).**

5. Calculate and construct an astable multivibrator using a 555 timer, to produce a _____ KHz signal at _____ % duty cycle. Calculate and measure the Vc voltage and the output signal.

6. Calculate and construct a monostable multivibrator using a 555 timer, to produce a 5us pulse for every trigger. Use the output of the astable you made in step 5 above to make the trigger for this circuit. **Verify your working circuit with your instructor (3).**

7. Look up and document how a 74121 IC chip works. Connect it to produce a _____ ms pulse for every trigger. **Verify your working circuit with your instructor (4).**