EE 1202 Experiment #1 – Building an Electronic Circuit

1. **Introduction:**
   - **<u>Billions</u> of PCB's are manufactured annually.**
   - **Commercially, soldering and component placement are done with large, computer-controlled manufacturing machines.**
   - **This lab gives a you chance to look at the process manually.**

2. **Equipment List: The following items are required for this procedure:**
   - **Flashing LED kit, available at the University book store.**
   - **Nine-volt battery (should come with parts kit).**
   - **Soldering toolkit (with practice PCB's), soldering irons, available in lab.**
   - **Plywood soldering surface, available in lab.**

3. **Pre-Work: Prior to the laboratory, study this outline and review the briefing you were given in class. Also, <u>complete the Worksheet</u>.**
4. **Experimental Procedure: Check the laboratory toolkit for:**

- Mesh soldering iron tip cleaner. **- Solder (small tube of soft wire).** **- Wire cutters/wire stripper.** **- Alligator-clip part holder.**	**-Solder removal devices ("solder sucker" and solder wick).** **- Other tools (needle-nose pliers, etc.)**

4.1. Soldering practice: (Note: <u>A soldering iron can cause severe burns</u>!)

4.1.1. <u>Do soldering on the plywood work surface</u>.

4.1.2. Put a practice solder PCB in the alligator-clamp holder.

4.1.3. Put soldering iron in a stand and plug in (turn on bench power).

4.1.4. Position wire-mesh solder tip cleaner near your work.

4.1.5. When iron is hot (3-5 minutes), "tin" the tip as shown in Fig. 1.

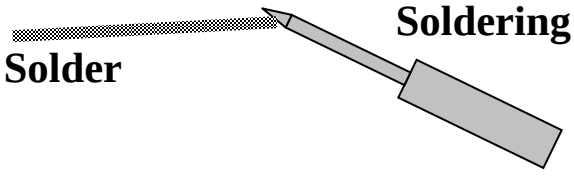

Fig. 1. Tinning the soldering iron.

4.1.6. Stick the soldering iron in the tip cleaner frequently to clean it off.

4.1.7. Good soldering technique takes practice.

4.1.8. Solder several wires to the practice PCB (Fig. 2). It should take a few wires to get a good technique. (Note: a good solder joint is "shiny.")

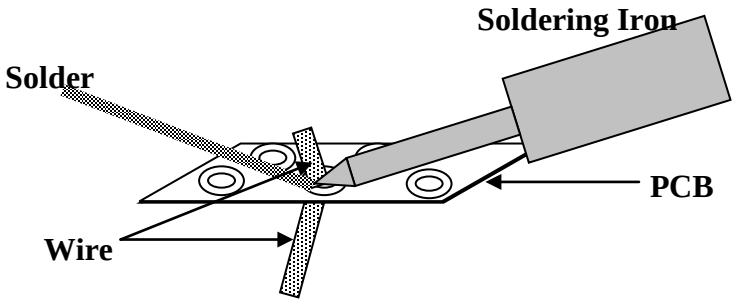

Fig. 2. Correct placement of components for soldering.

4.2. Construction of the Circuit:

4.2.1. Insert parts on PCB side that has component outlines and ID's on it.

4.2.2. Attach resistors first (align in same position for identification purposes). Position as close to PCB as possible.

4.2.3. Bend resistor leads out, to hold resistor in place.

4.2.4. After checking resistor placement, solder them in place, trim leads.

4.2.5. Continue with remaining components, as discussed in briefing.

4.2.6. Trade PCB's with your partner and check each other's work.

4.2.7. Remember that solder will be hot for a while after soldering.

4.2.8. Solder in battery connector wires last, and connect battery.

4.2.9. If LED's are flashing, the assembly process is complete. If the circuit does not appear to operate, check component placement.

5. Adjusting Flasher Circuit: (Use small screw driver from toolkit.)

5.1. Experiment with Flasher Timing: (Record required data on Data Sheet!)

5.1.1. Adjust potentiometers for maximum flash time, and record as accurately as possible (one "flash time" = time for both LED's to flash).

5.1.2. Adjust for minimum flash time and record. As it is hard to time single flashes at this speed, have partner count the flashes in five seconds. Divide by five to get the frequency; take the inverse to get the period.

5.1.3. Adjust flash cycle to about one second. Time and record flashes over a one minute period. Repeat for two more 1-minute cycles. Is the flash cycle consistent (see "Writing the Laboratory Report," below)?

6. Laboratory Area Cleanup: Replace equipment in the cabinet. Make sure work area is clean, and approved by TA. Save the 9V battery for Lab Exercise #6.

7. Writing the Laboratory Report: Complete your laboratory report according to the form (see Appendix C). Remember to include the Experiment #1 data sheet. In your write-up, discuss adjustment of the flasher. Summarize measurements of the minimum and maximum flash times.

7.1. Discuss the consistency of the flash cycle.

7.2. How easy was it to adjust the cycle to a given timing?

7.3. Discuss problems in constructing the PCB, such as component placement.

Experiment #1 Data Sheet

Fill in the blanks below to assure that you have all the data required in Experiment #1. Also, remember to write down any thoughts on the experiment while it is still fresh in your mind.

1. **Maximum flash time of both LEDs: _____ seconds.**

2. **Minimum flash time of both LEDs: _____ seconds.**

3. **One-minute flash timing: How many flashes did each LED make (should be Close to 60)? Try 1: _____ Try 2: _____ Try 3: _____**

4. **How consistent was the flash cycle? _____**

   _____

5. **How easy was it to adjust the timing of the LED flash cycle?**

   _____

6. **List any problems in soldering. _____**

   _____

7. **List any other problems in building the electronics kit:**

   _____

   _____

8. **List lessons learned (other than soldering):**

   _____

   _____

   _____

9. **What is the tolerance of the resisters in the LED flasher kit?**

   _____

Experiment #1 Worksheet

Note: Refer to Experiment #1 description above, to the LED blinker-light kit instructions, and to Appendix B to answer the questions below.

1. **State the resistor value in Ohms (Ω) and the tolerance for the following:**

   a. **Brown-black-red-gold:** _____

   b. **Green-blue-yellow-silver:** _____

   c. **Red-red-orange-none:** _____

   d. **Orange-purple-green-gold** _____

   e. **Blue-red-gold-silver** _____

2. **What are the correct color codes for the following resistors?**

   a. **1.6KΩ, 5%** _____

   b. **9.7MΩ, 5%** _____

   c. **2.2KΩ, 5%** _____

   d. **5.6Ω, 20%** _____

   e. **200KΩ, 10%** _____

3. **What is another name for a "potentiometer?"** _____

4. **Given a signal with a frequency *f*, (such as the alternating blinks of the blinking LED circuit), what is the mathematical definition of the period of that signal?**

   _____

5. **What do the initials "PCB" stand for in electronics?**

   _____