# Electronics Merit Badge

## Class 4





# Soldering

*Safety Note: A Soldering Iron gets hotter than 374 F. Do not touch the soldering iron's metal parts or you will receive a third degree burn. Wear safety glasses when soldering.*

**A good solder joint depends on the following:**

1) **Solder iron must have a clean, well-tinned tip. Tin the tip by wiping the heated tip on the sponge, and then applying fresh solder to the tip. This will allow for a better heat transfer from the tip to the PC board.**

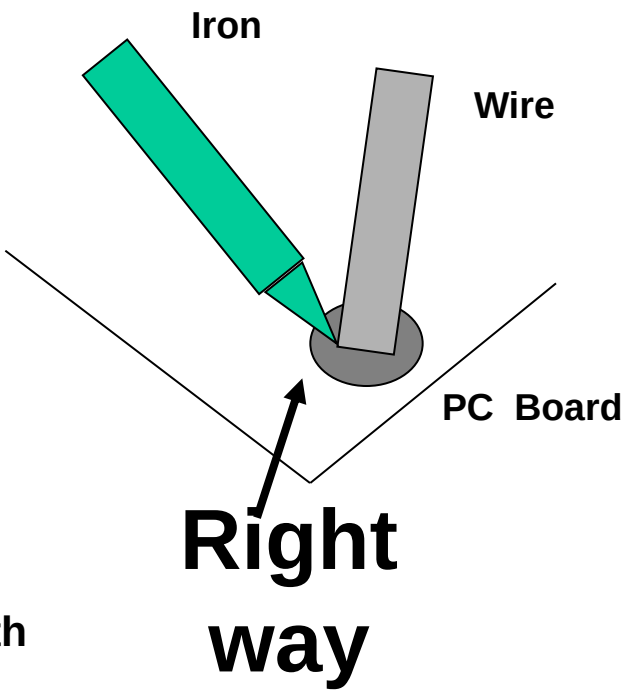
2) **Parts to be soldered must be clean.**

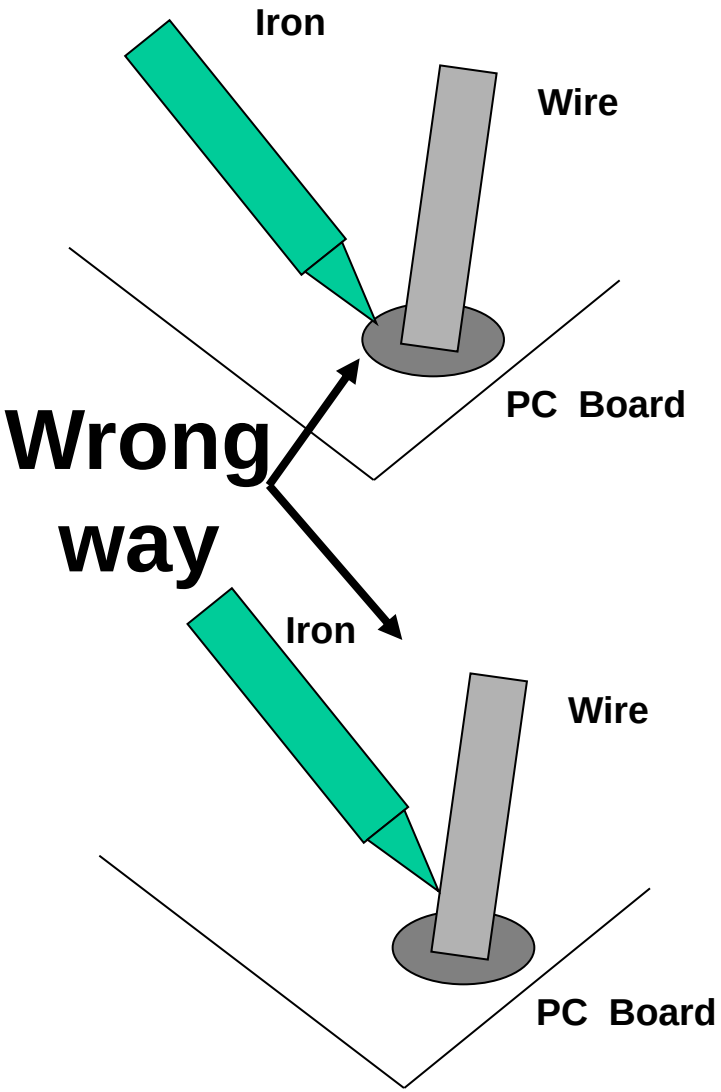
3) **There must be a sound mechanical joint.**

4) **Parts to be soldered must be well heated before applying solder.**

5) **Wait approx. 5 seconds after soldering to allow strong mechanical joint to form.**

# Soldering



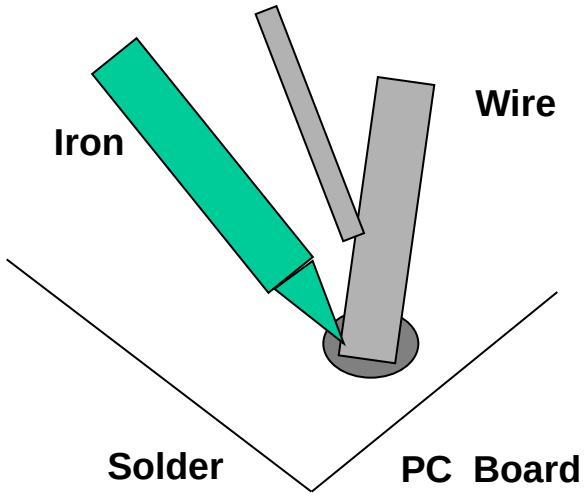




Solder melts at 374 F. So the wire and PC board must be the same temperature for the solder to melt on both items.

Place soldering iron so that it touches both the PC board and wire. The heat from the soldering iron will transfer to the PC board and wire at the same time.

# Soldering

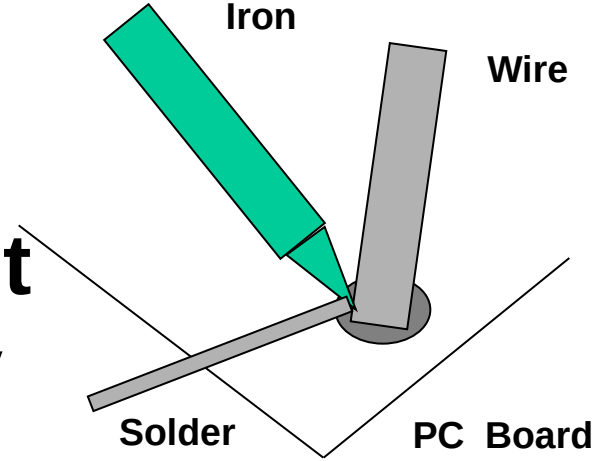
## Wrong way

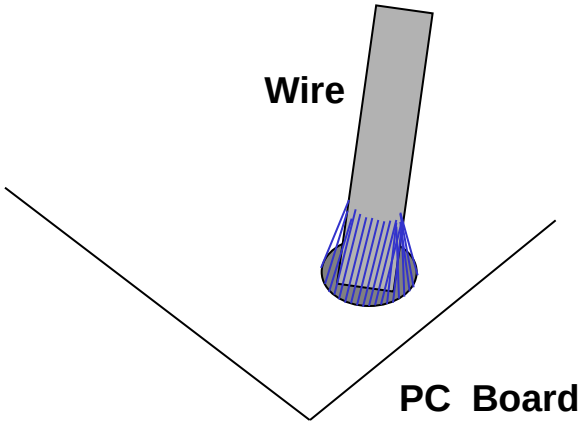



When the board and wire are hot enough, the solder will flow and create a cone shape. If the board is not hot enough the solder will be rounded on the board, creating somewhat of a ball. The finished solder joint should also be shiny.

After 3 seconds place the solder on the tip of the iron, the wire, and the PC board all together.
The solder should flow to everything making a good connection.

## Right way



# Un-Soldering

1. **Use pliers to hold the *body* of the component to be removed. If the *lead* is held with the pliers it will draw heat from the lead, and you may damage the part and possibly the board.**

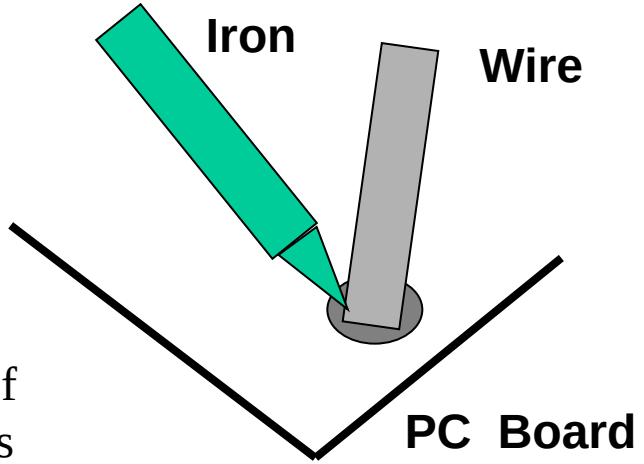
2. **Apply soldering iron tip to printed circuit board and the component lead. It is common to add a little fresh solder to the lead and board, to improve heat transfer.**

3. **Using the pliers, simply pull the component lead from PC board while holding the soldering iron on the lead.**

4. **The soldering Iron will damage electronic components if left on device for greater than 15 seconds, so work quickly.**

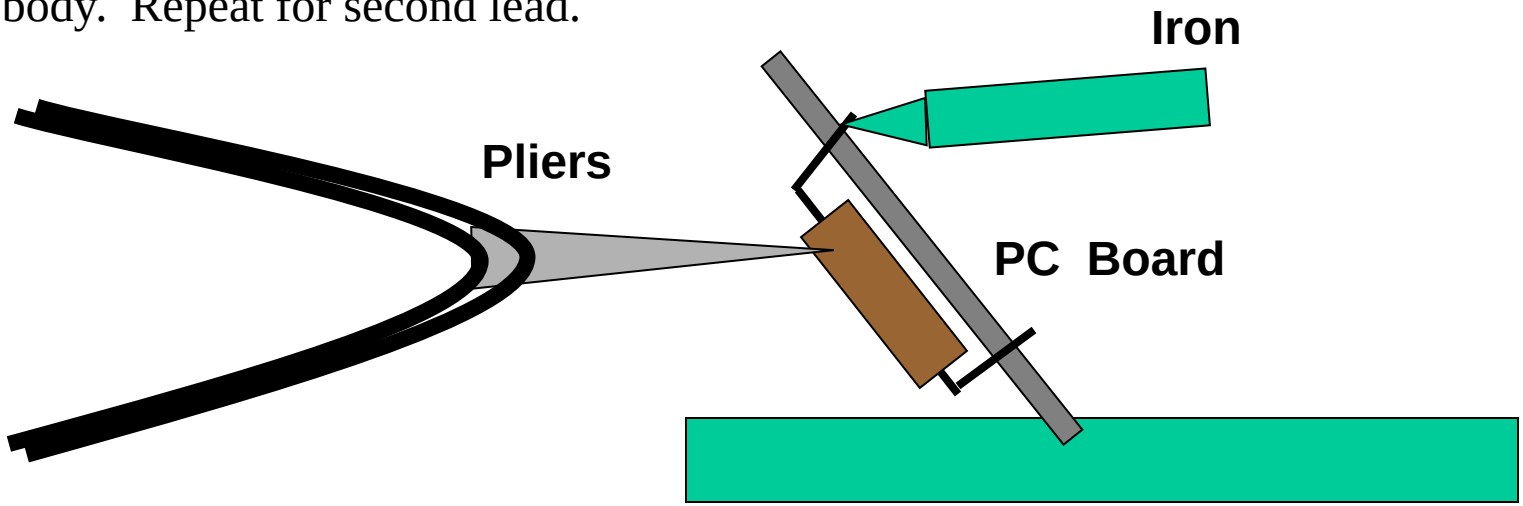
5. **Clean soldering iron tip and keep it shiny.**

# Un-Soldering



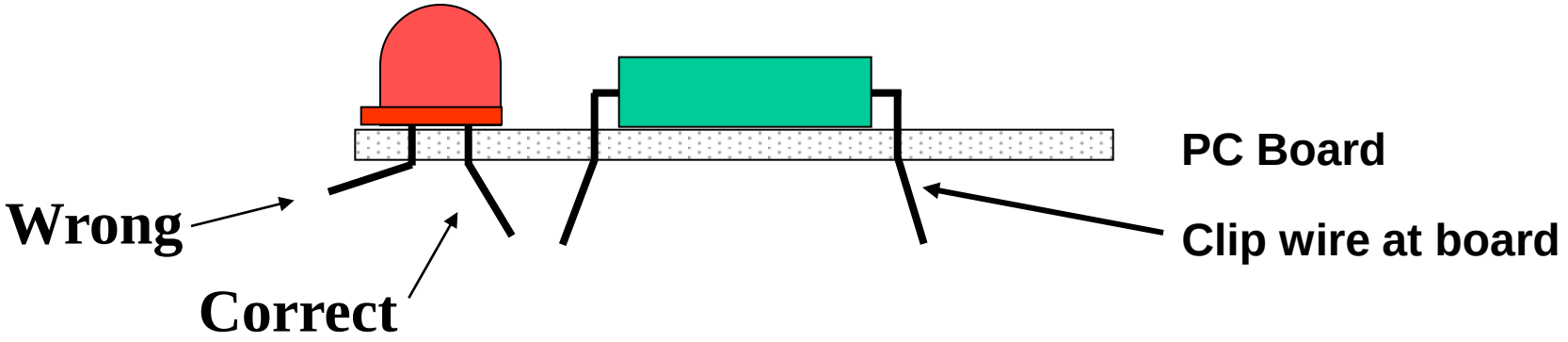

**Unsolder one component from the board.**

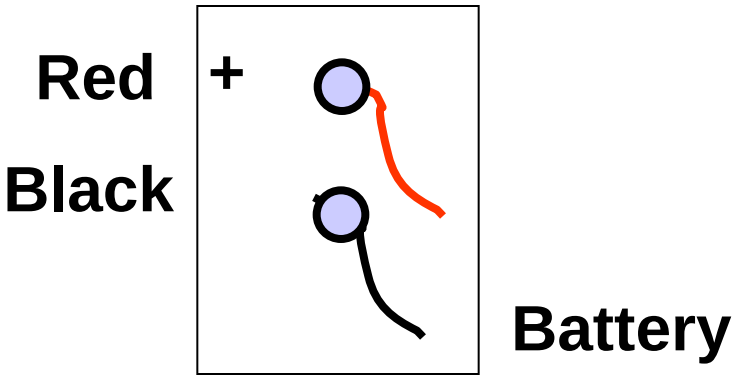
With pliers, hold the body of the part to be unsoldered. As heat is applied, pull the lead from the board by pulling on the body. Repeat for second lead.

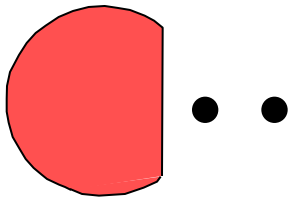


# Soldering Kit

1. Place components into PC board in the order recommended on instruction sheet
2. Bend leads out slightly to keep parts in place.
3. Follow instructions as to proper orientation of components.



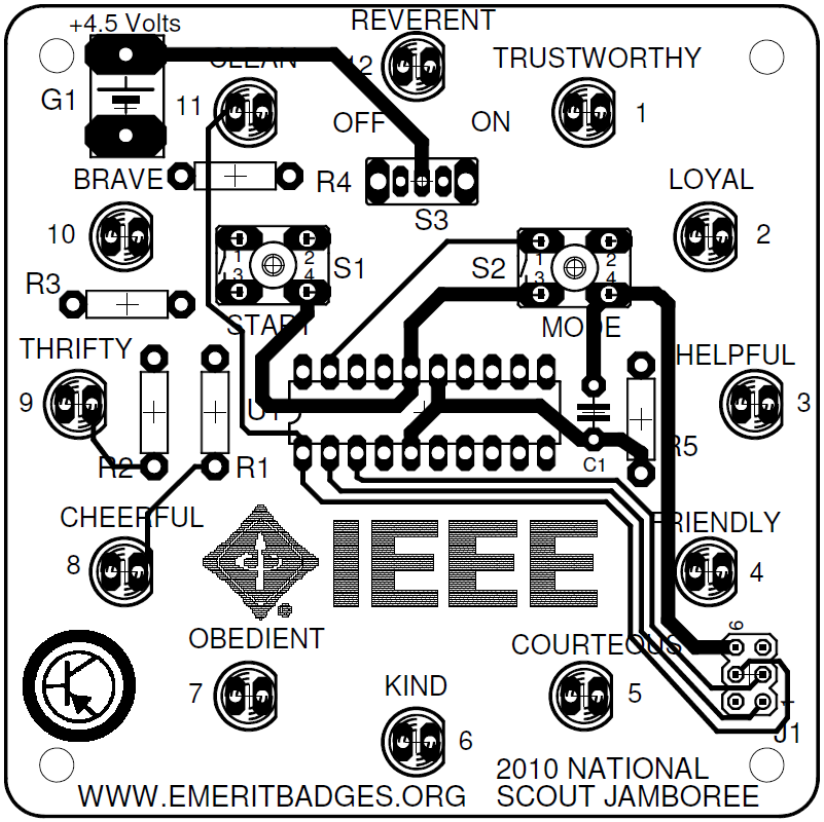
LED
Note flat edge
Short lead is closest to flat edge.

# Microprocessor Controlled Counter

## Assembly Sequence

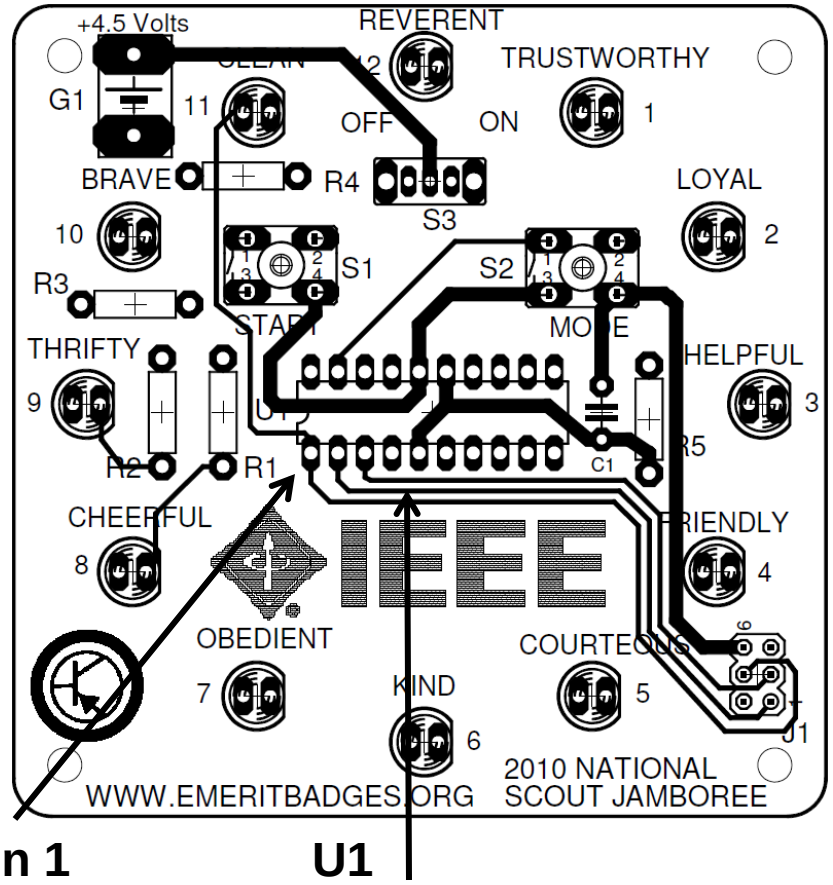
1. Place U1 on board.  Note pin 1 orientation. Solder component into place.
2. Place all LEDs in board, bend leads out and solder, then cut leads.
3. Place resistors in board, bend leads out and solder, then cut leads.
4. Place capacitor in board, bend leads out and solder, then cut leads.
5. Place Switch S1, S2 & S3 in board and solder.
6. Place Red and Black battery wires from the back of the board and solder.
7. Place battery in box and cover with PC  board
8. Use two screws to secure the PC board to box.

# Microprocessor Controlled Counter Kit

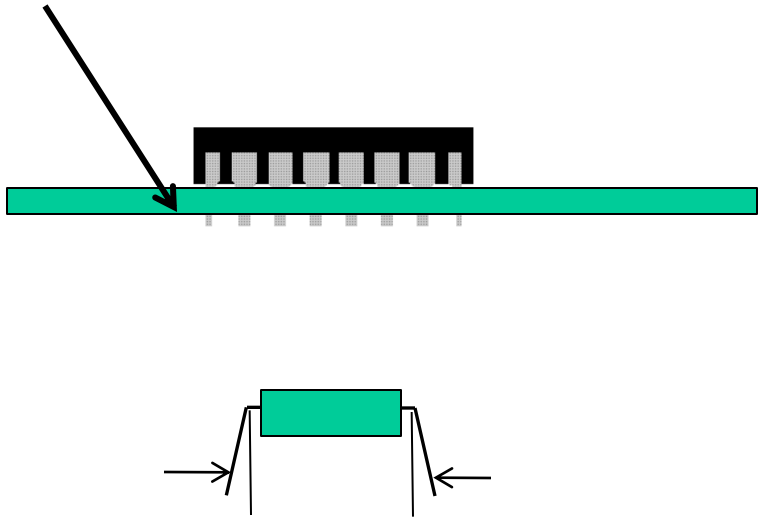



1. PC board
2. 5 resistors R1-R4 =200Ω, R5=56KΩ
3. 1 Microprocessor –Atmel ATTINY861-20PU (U1)
4. 1 Capacitor C1 =.01uf
5. 12 LED's
6. 1 slide switch S3, 2 push buttons S1 & S2
7. one battery holder and one box – 2 screws

# Microprocessor Controlled Counter Kit



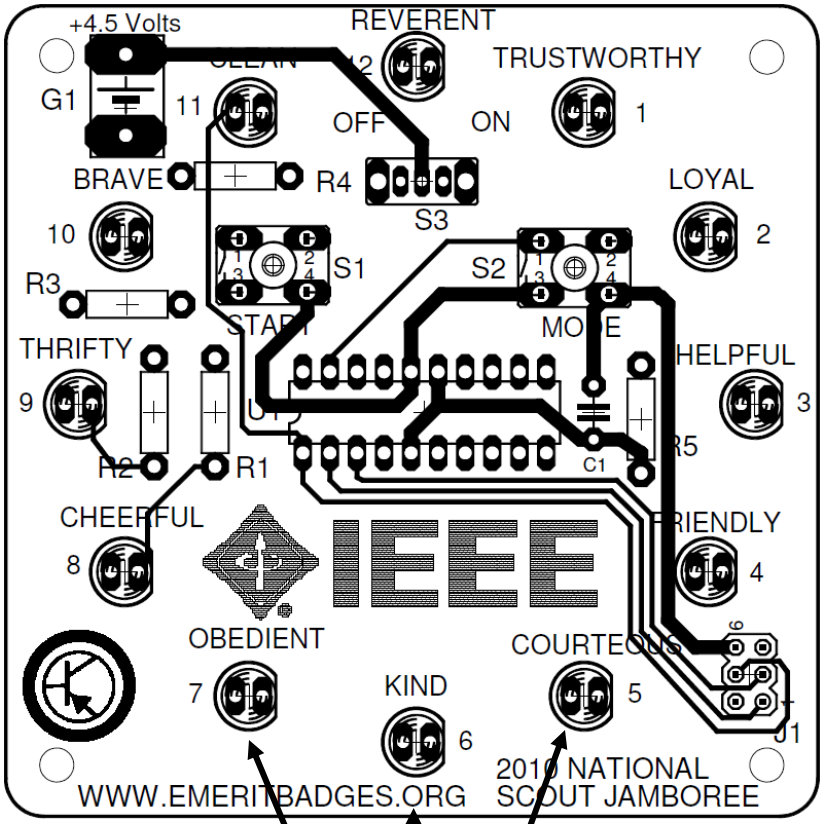

**Insert U1 into proper position on the board. Leads should come out the bottom of the board.**

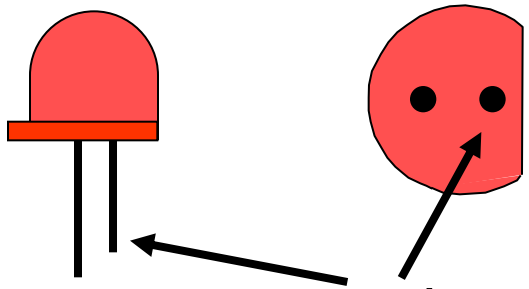


**1) Solder 20-pin DIP (Microprocessor) in U1 location. Orient U1 so that pin 1 is on the left.**

**Note: You will need to bend all leads on each side to be more perpendicular to body of the component, before inserting the leads in the board.**

# Microprocessor Controlled Counter Kit



**LED**
**Note: Flat Edge**

Shorter Lead

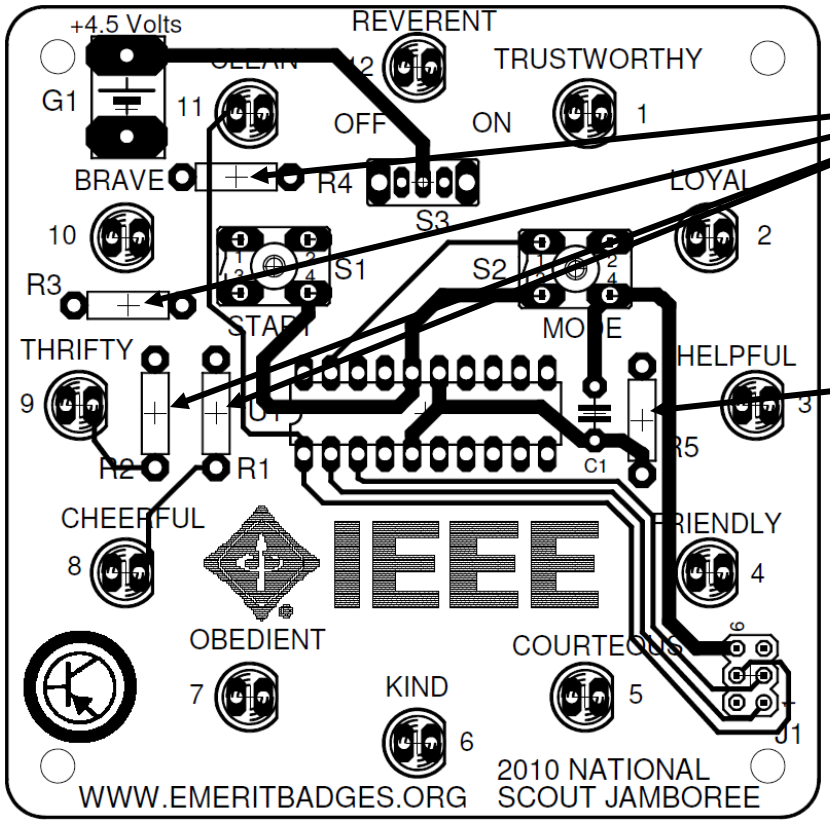
Cut when soldered

LED against board

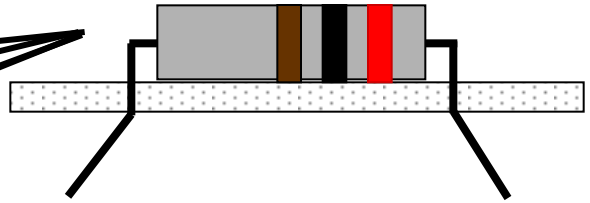
**When soldering LED's, do not leave the solder iron on pads for more than 5 seconds, or you will destroy the pad.**

2) **Place LED's on PC board, <u>flat side of LED's facing right</u>, bend leads out, then solder leads. After soldering, cut leads close to board. There are 12 of these. Hint: Solder only 1 lead of each LED. Place solder iron on soldered lead, melting solder, and then press LED flush to the board. Then solder the other lead.**

# Microprocessor Controlled Counter Kit

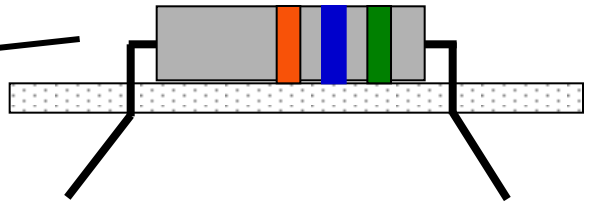



**R1,R2,R3,R4 = 200**



**PC Board**

**R5 = 56K**

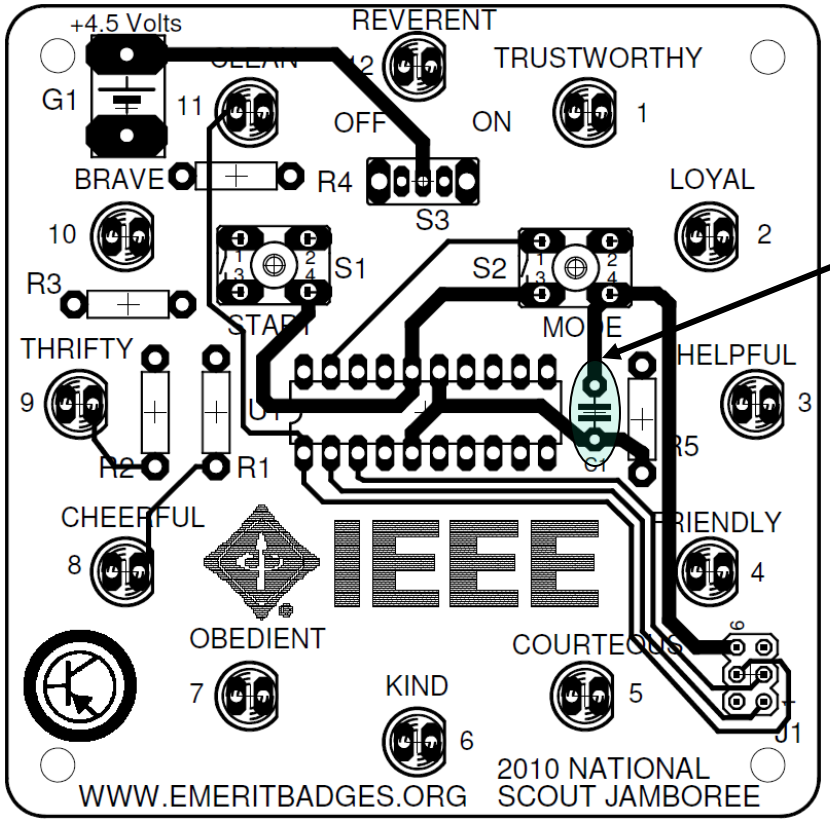


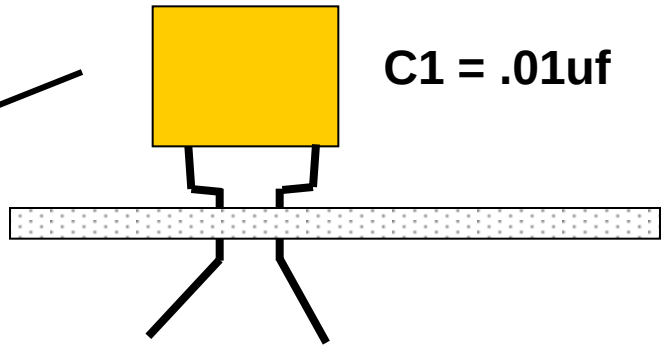
**PC Board**

| | |
|---|---|
| **R1-R4** | **200Ω, (red, black, brown)** |
| **R5** | **56KΩ, (green, blue, orange)** |

**3) Place Resistors, bend leads out, then solder. Clip leads when done. Orientation of resistor does not matter.**

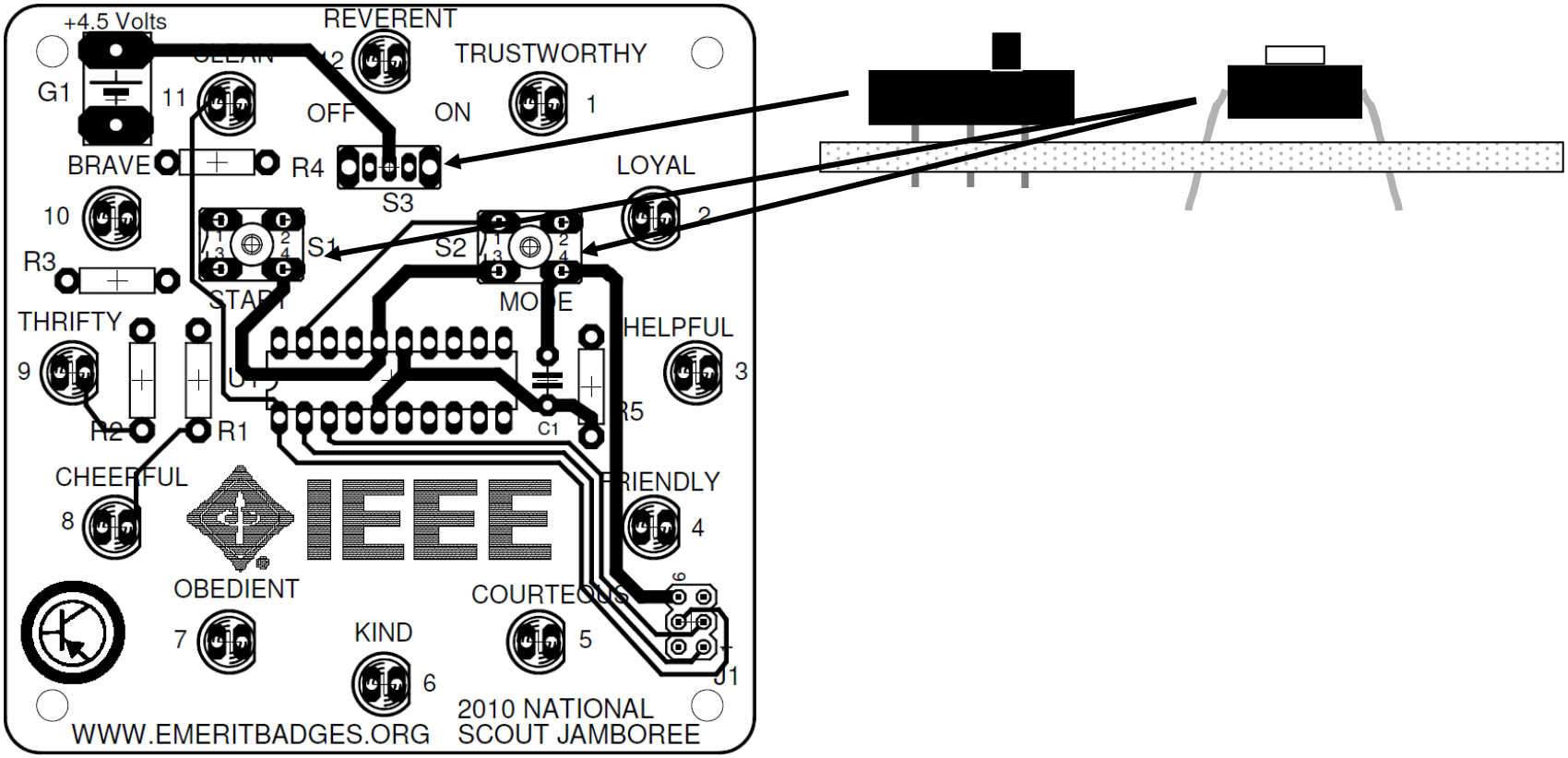
# Microprocessor Controlled Counter Kit



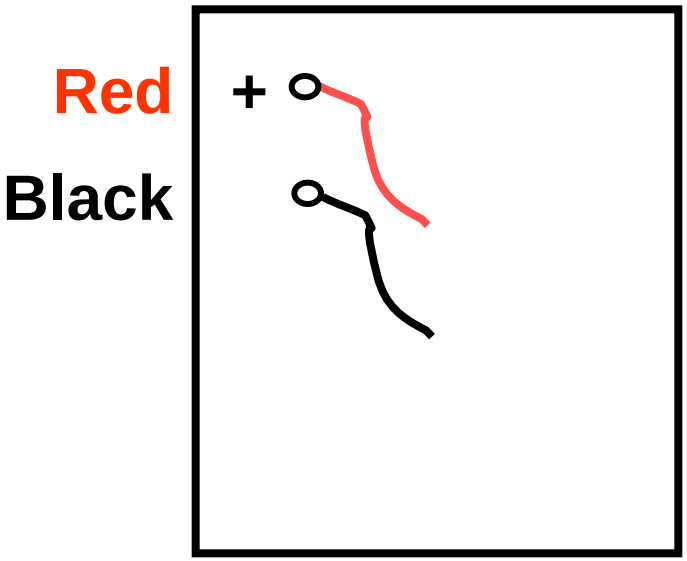

4) **Place capacitor at C1. Bend leads out. Solder leads. Orientation of capacitor does not matter.**

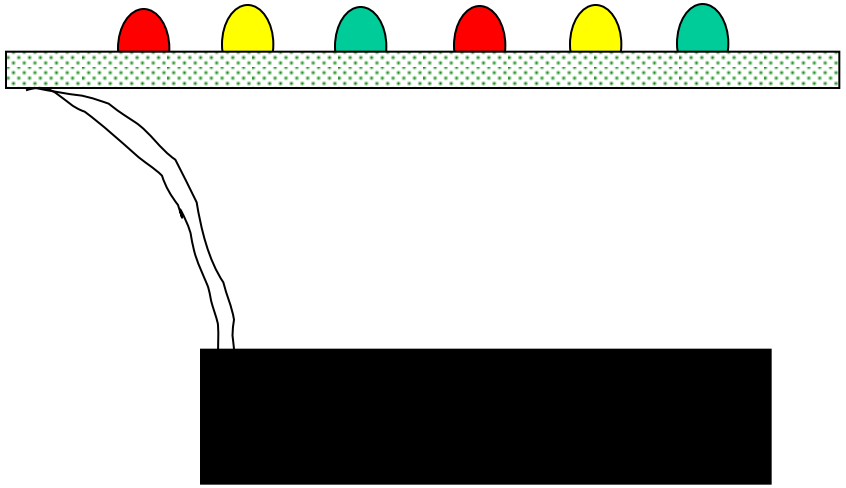
# Microprocessor Controlled Counter Kit




5) **Place Switches S1, S2 and S3 in their appropriate positions and solder. Make sure S3 (slide switch) is vertical, before soldering all the leads.**

# Microprocessor Controlled Counter Kit

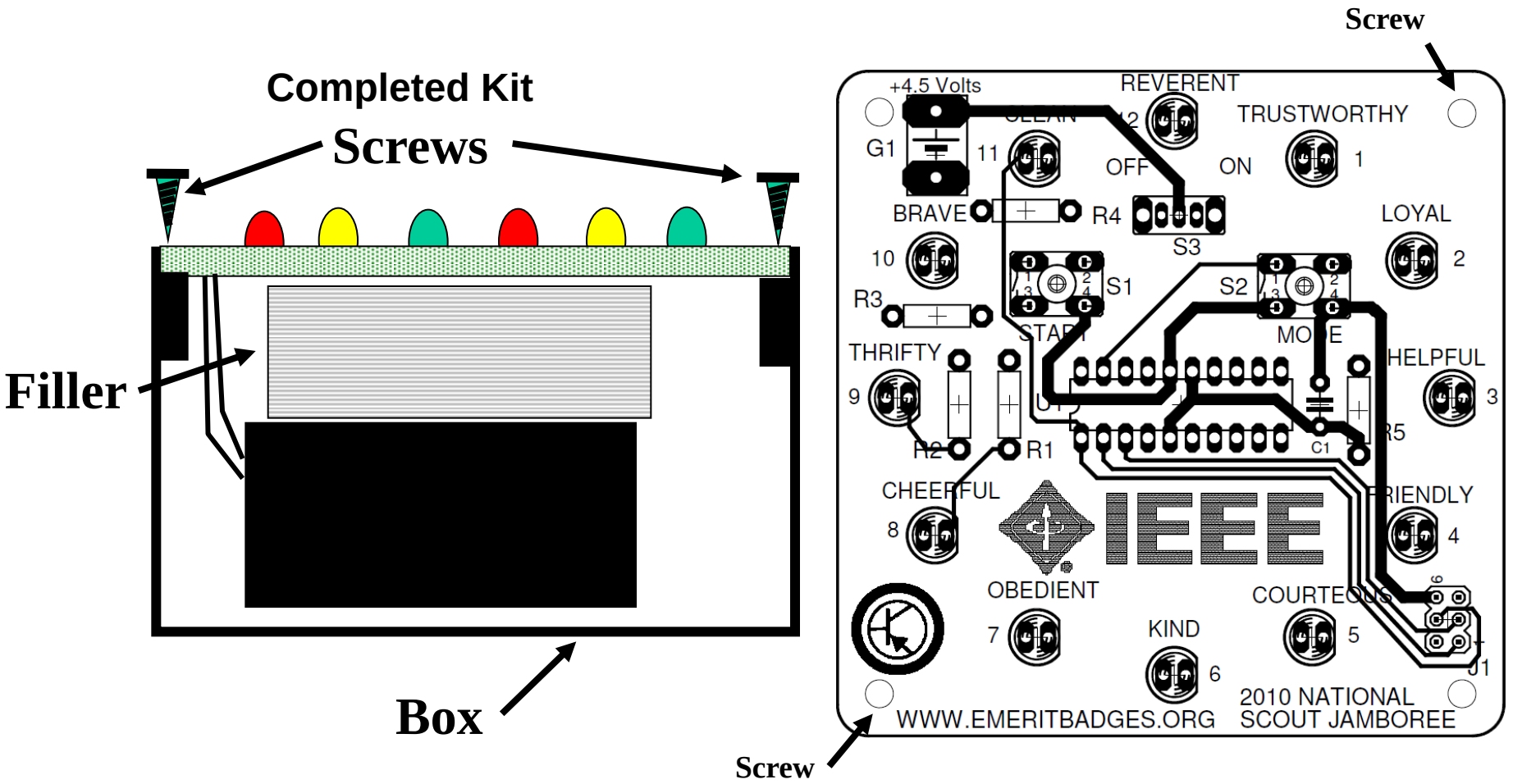


6) From the bottom of the board, insert the red battery holder lead into the + hole. Insert the black lead into the other hole. From the top of the board, solder both battery leads.

7) Inspect board for good solder joints and for no solder shorts. Connect the battery and turn unit on. If unit does not work, have an instructor check it for problems.

# Microprocessor Controlled Counter Kit




8) Place the battery in the box. Place foam/filler on top of the battery. Place the board onto the top of the box, and using the two screws, affix the board to the box. Place the screws in opposite corners.