

# Electronics Merit Badge

## Class 4



Name \_\_\_\_\_



# Electronics Merit Badge

Class 1	AC Power Sources DC Power Sources Voltage, Current and Resistance Build Circuit with Light, Buzzer and Switch
Class 2	Components - Passive and Active Ohms Law Ohms Law Tool Kit Transistor Logic IC Logic
Class 3	Binary Logic Binary / Hex Tool Kit LED Circuit Design
<b>Class 4</b>	<b>Solder Theory</b> <b>Solder Practice</b> <b>Build LED Kit</b>

# Soldering

*Safety Note: A Soldering Iron gets hotter than 300 F. Do not touch the soldering iron's metal parts or you will receive a third degree burn.*

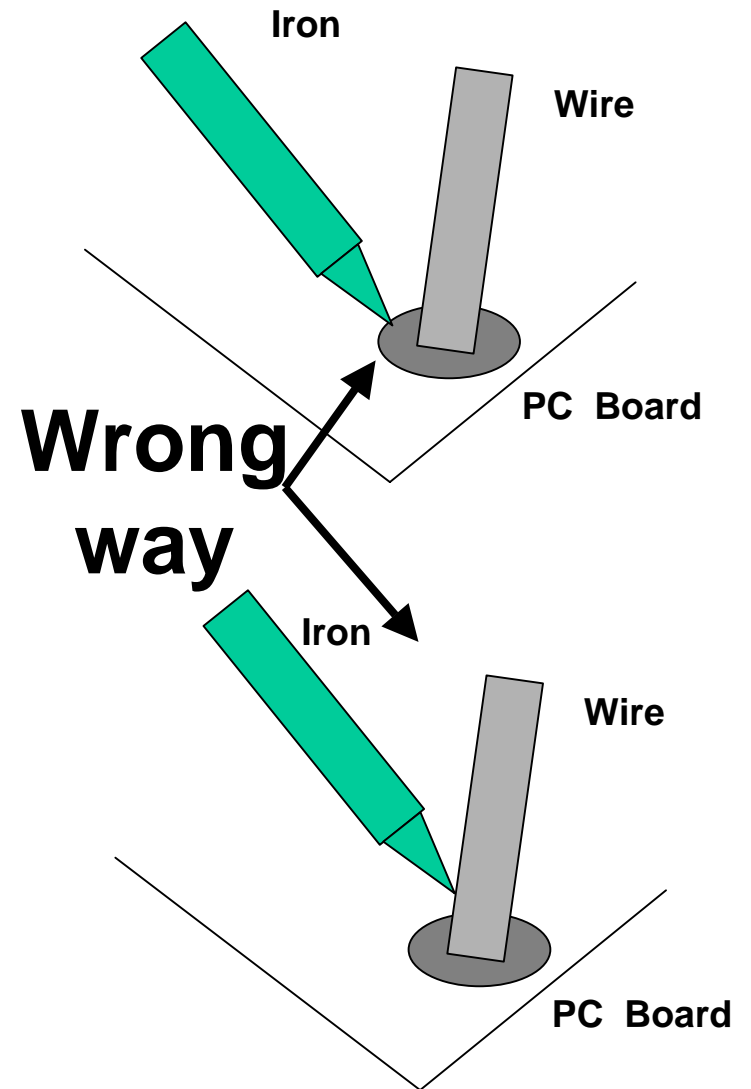
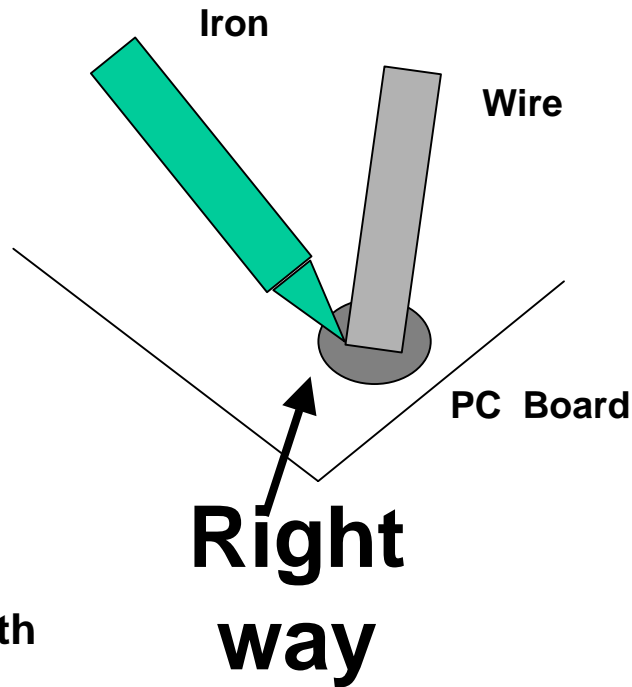
**A good solder joint depends on the following:**

- 1) Solder iron must have a clean, well-tinned tip.**
- 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.**
- 6) Where safety glasses when soldering.**

# Soldering

Solder melts at 310 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.

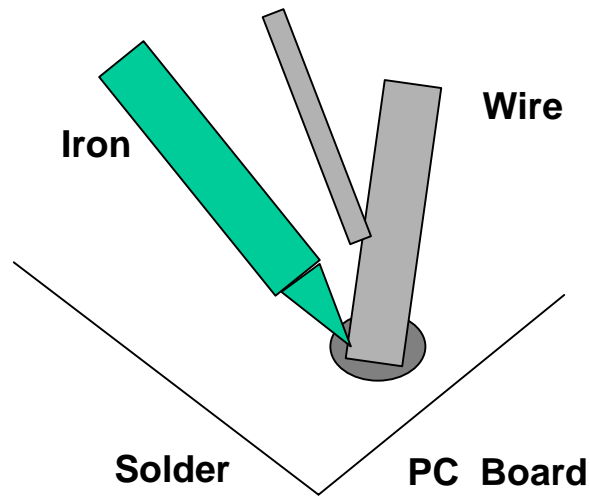


# Soldering

## Wrong way

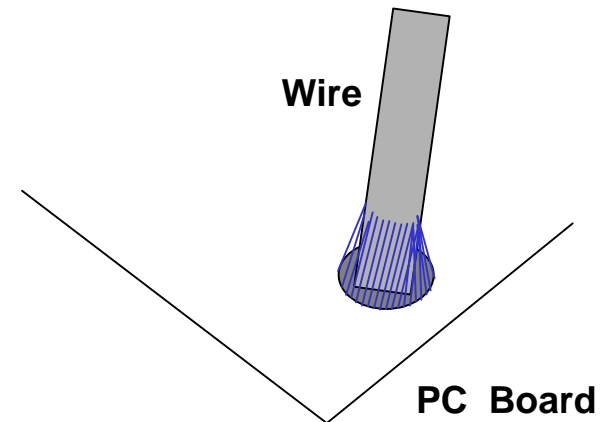
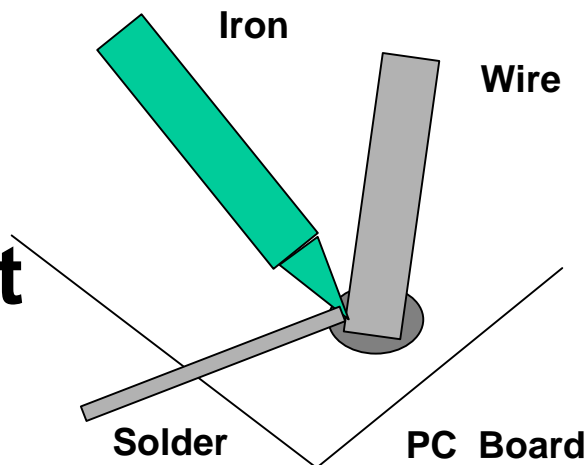
After 3 seconds place the solder on the tip of the iron, the wire and the PC board all together.

The solder should flow to everything making a good connection



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 finishing solder should also be shiny. Clip extra wire at board level.

## Right way



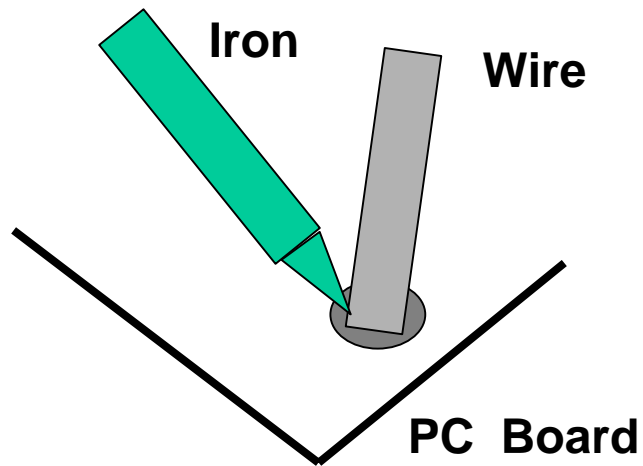
1m  
3m

# Un-Soldering

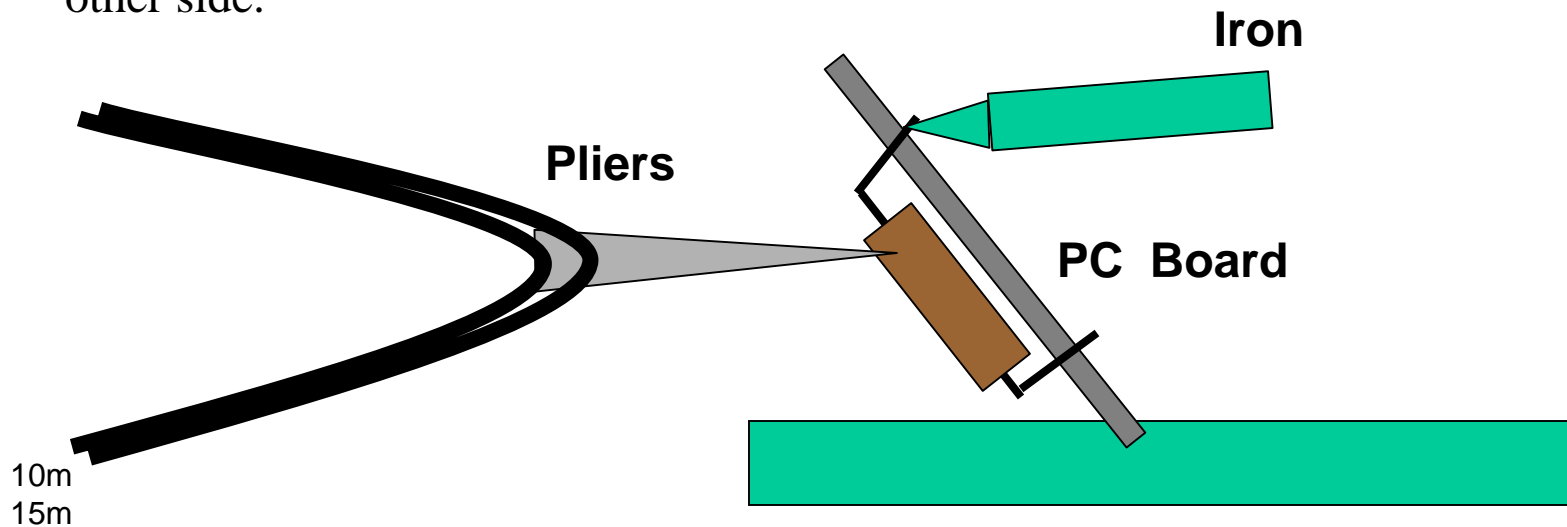
- 1) Unsolder two parts from the PC board.
- 2) Use pliers to hold the component next to the lead to be unsoldered. If the lead is held with the pliers it will draw heat from the lead.
- 3) Apply soldering iron tip to PC board and wire
- 4) Either use solder wick or solder sucker to draw solder off the board. Or simply pull wire from PC board when hot.
- 5) The soldering Iron will damage electronic components if left on device for greater than 15 seconds. So work quickly. Sometimes it helps to put more solder on the solder joint to improve the thermal conductivity.
- 6) Clean soldering iron tip and keep it shiny.

# Un-Soldering

With pliers, hold device close to lead that is to be unsoldered. As heat is applied from soldering iron, pull with pliers. With one side out, do the same on other side.

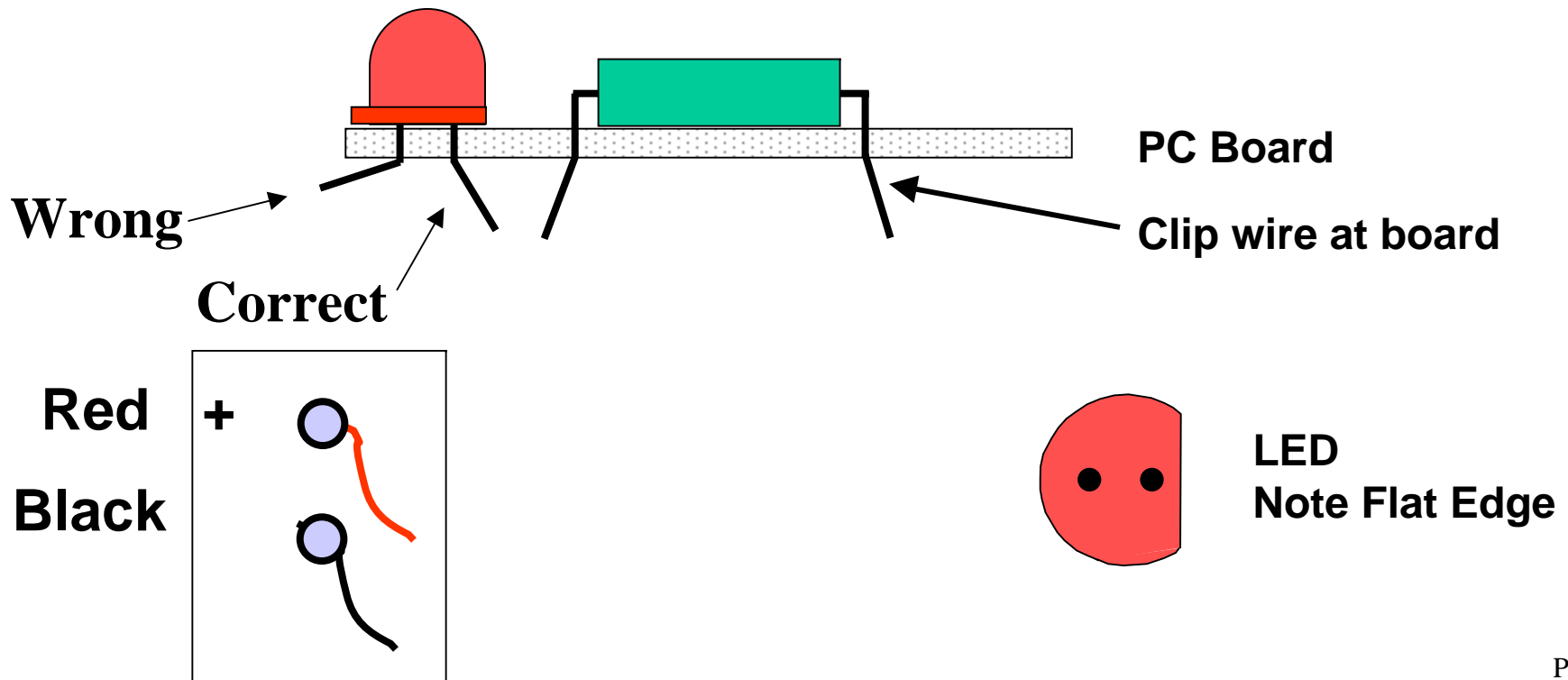


**Turn Soldering Irons on.  
Put safety glasses on  
Proceed to unsolder  
two components.**



# Soldering Kit

- 1) Place components into PC board in the order recommended on instruction sheet
- 2) When components are placed into PC board, bend leads out slightly to keep parts from falling out, when the PC board is turned over for soldering.
- 3) Follow instructions as to proper orientation of components.



# Micro-Processor Controlled Counter PROJECT

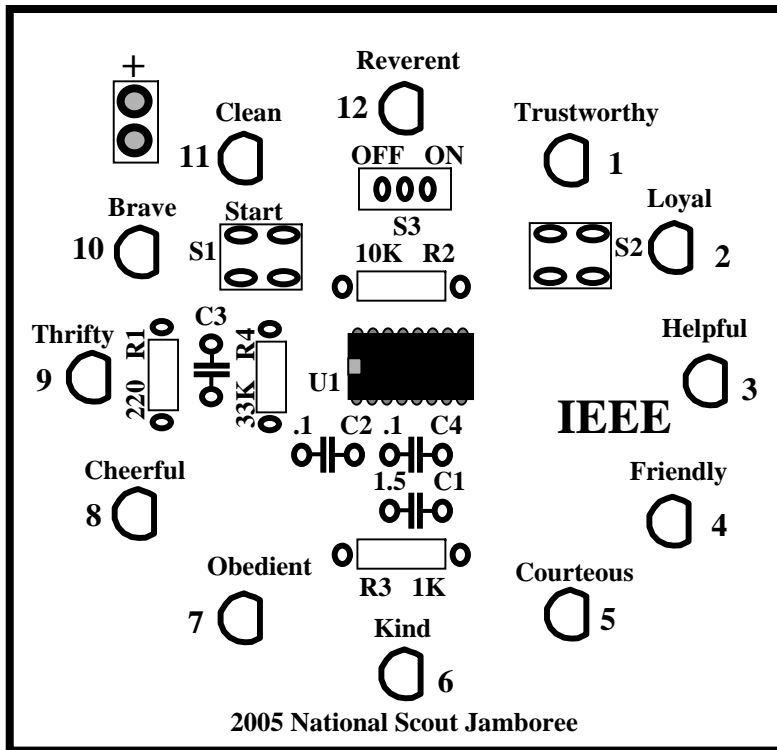
## Example

- 1) Place all LED's in board, bend leads out and solder, then cut leads.
- 2) Place Resistors in board, bend leads out and solder, then cut leads.
- 3) Place Capacitors in board, bend leads out and solder.
- 4) Place Switch S1, S2 & S3 in board and solder.
- 5) Place Red and Black Battery wire on back of board and solder.
- 6) Place Battery in box with foam and cover with PC board
- 7) Use two screws to secure the PC board to box.

Note: this is only an example to fulfill requirement 4b for a digital circuit. Audio and control projects are also accepted and encouraged for requirements 4a or 4c! This is NOT the only project; it is an example to understand the entire process.

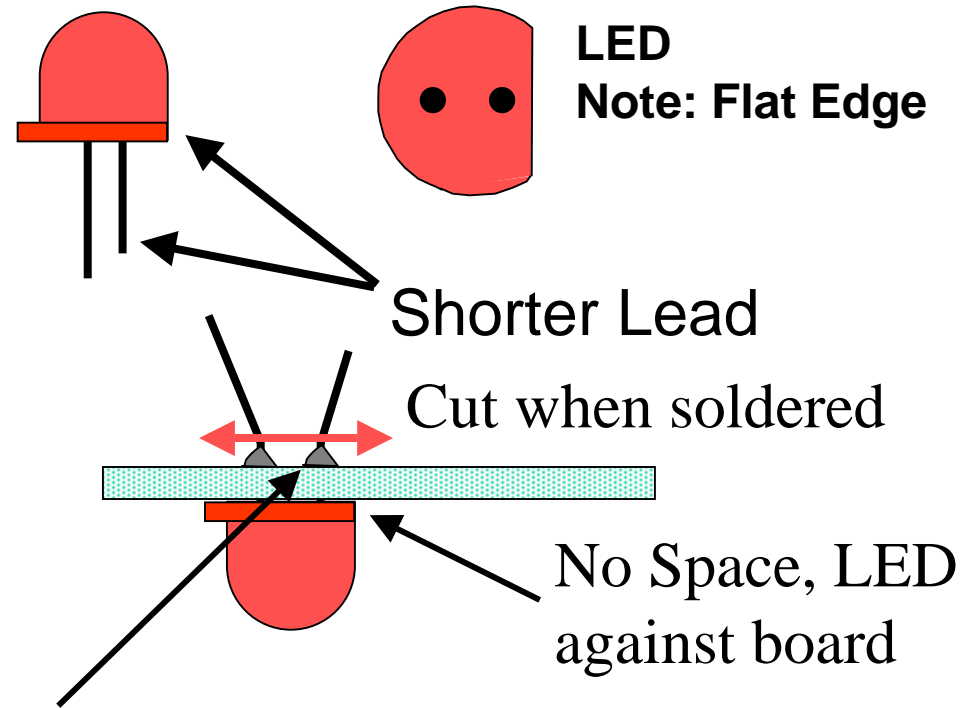
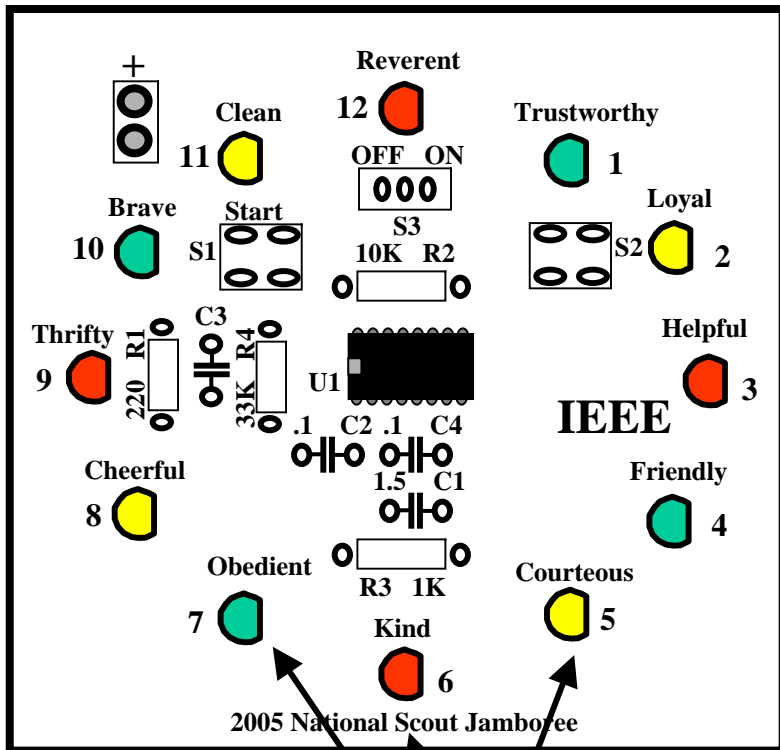
# Example Micro-Processor Controlled Counter Kit

## Raw PC Board



**Kit parts** PC board, 4 resistors R1=200, R2=10K, R3 = 1K, R4=33K, 3 Capacitors C2 =.1uf, C3 = 22uf, C4 =.1uf C1 not needed. 12 LED's 3 different colors, Red, Yellow, Green, 1 slide switch S3, 2 push button S1 & S2, one battery holder and one box

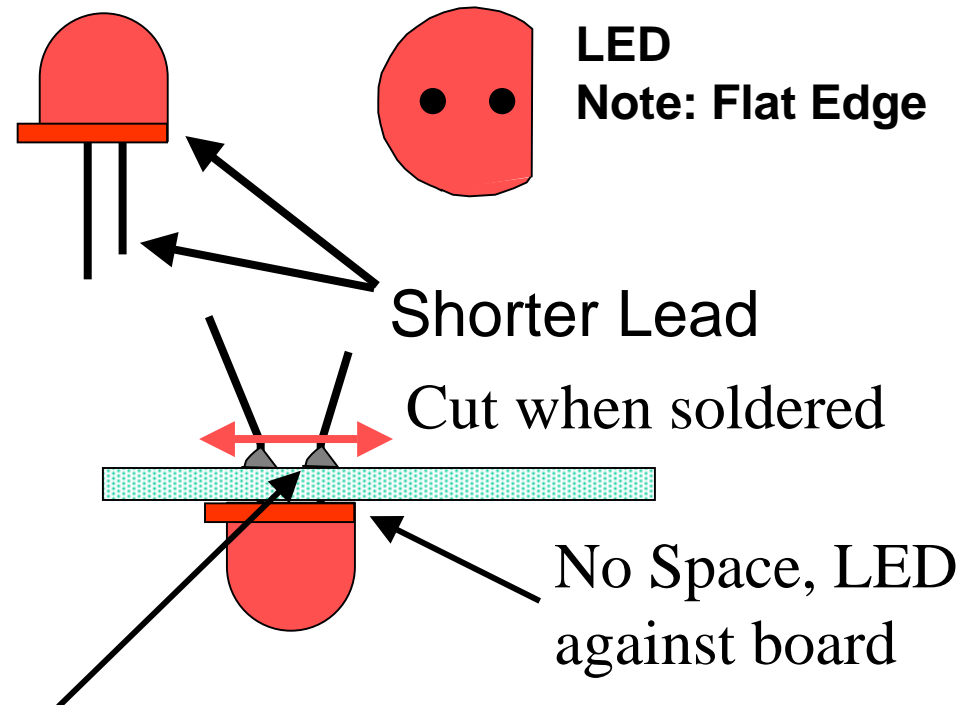
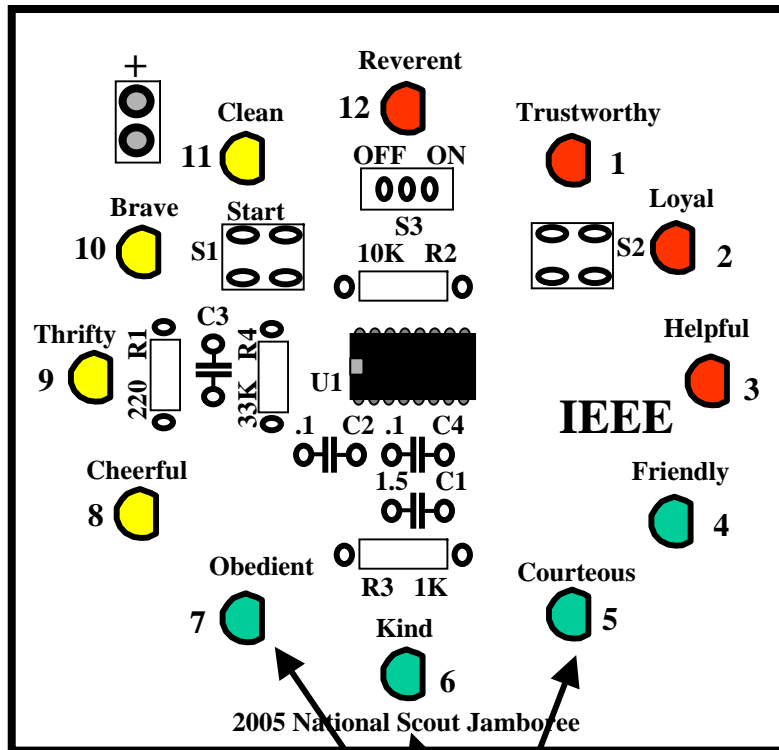
# Example Micro-Processor Controlled Counter Kit



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

- 1) Place LED's on PC board, flat side of LED's facing right, bend leads out, then solder leads. After soldering cut leads close to board.

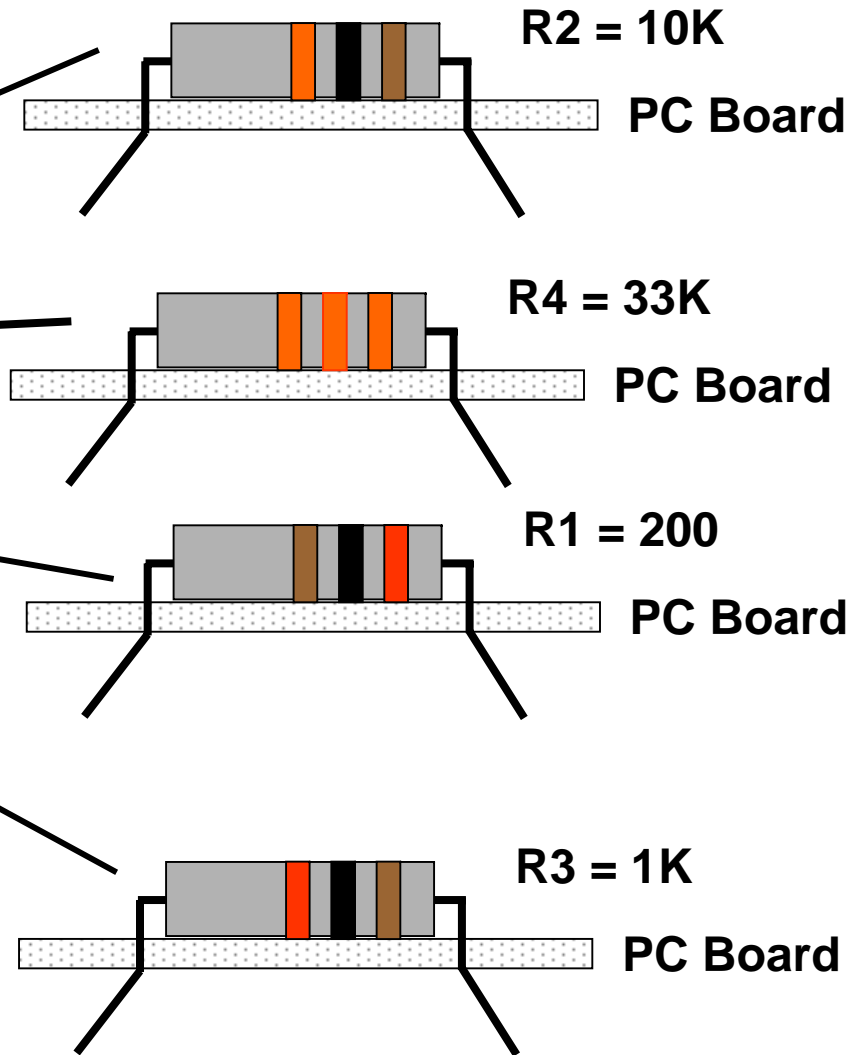
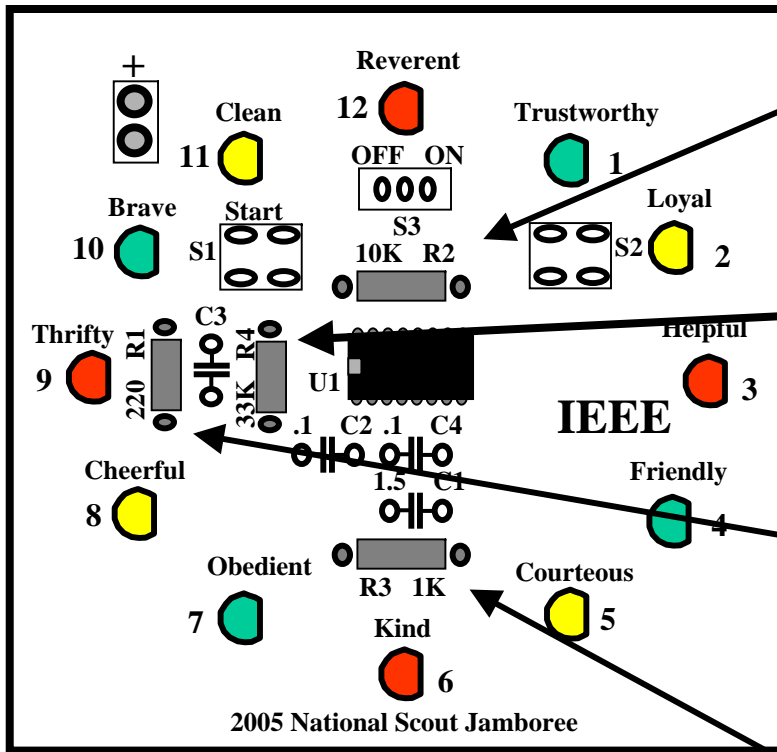
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# Example Micro-Processor Controlled Counter Kit

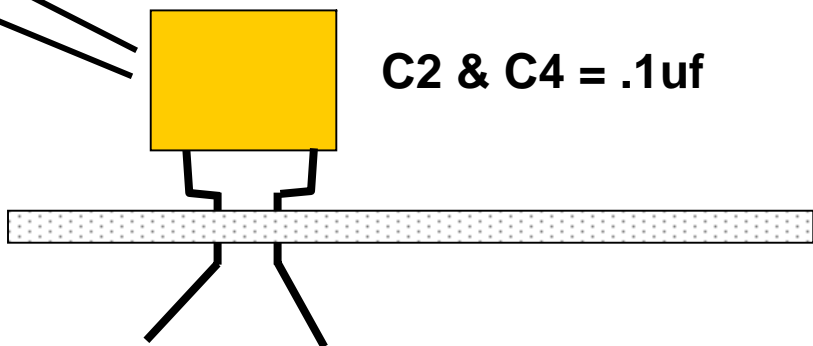
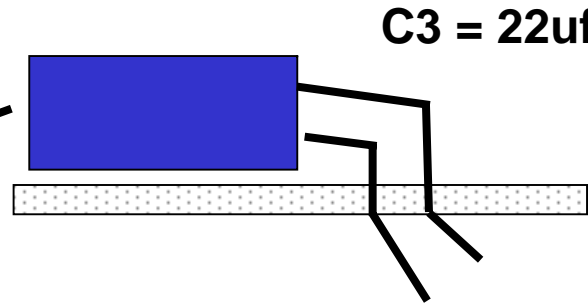
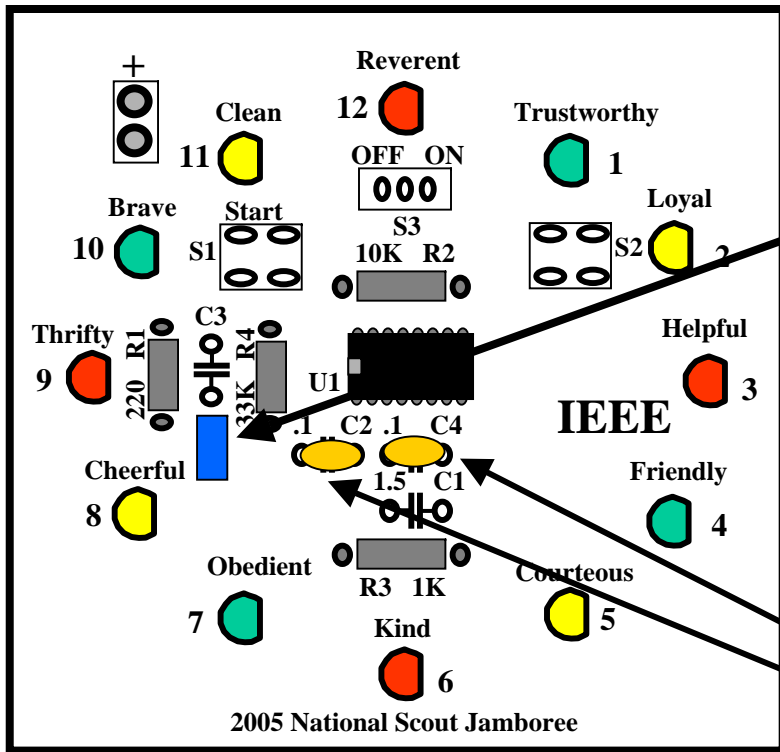


## 2) Place Resistors

- R1 200, (red, black, brown)
- R2 10K, (brown, black, orange)
- R3 1K, (brown, black, red)
- R4 33K, (orange, orange, orange)

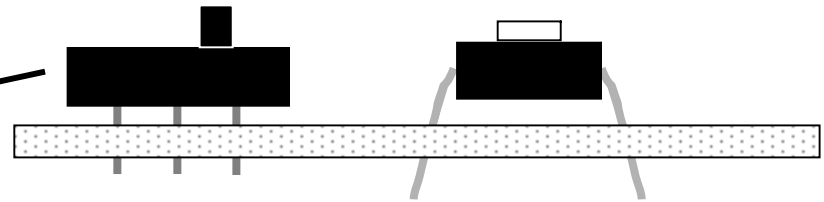
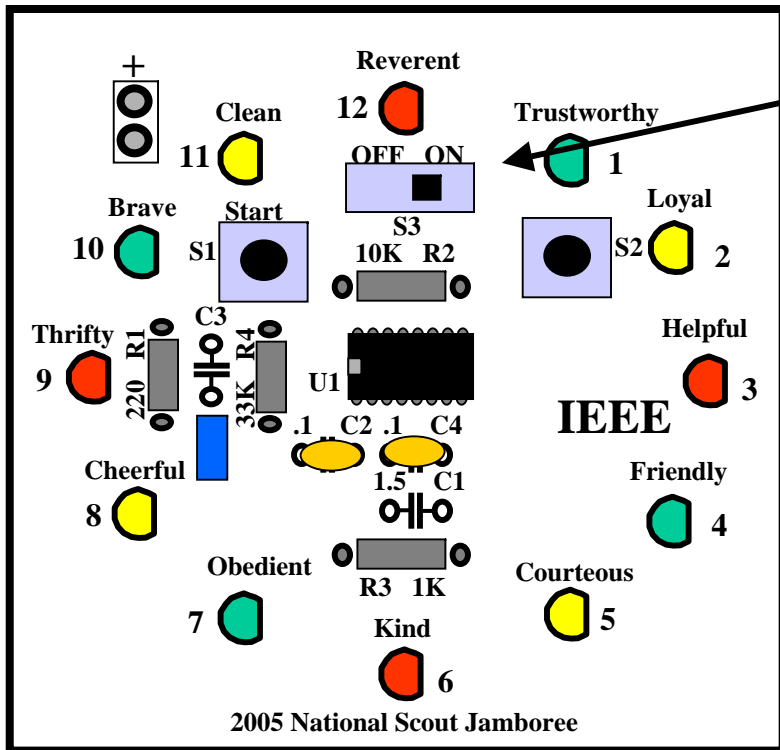
1m  
20m

# Example Micro-Processor Controlled Counter Kit



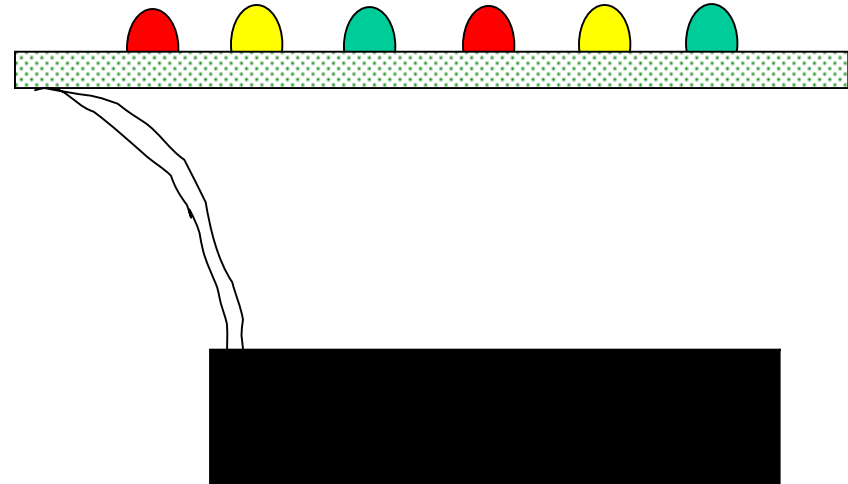
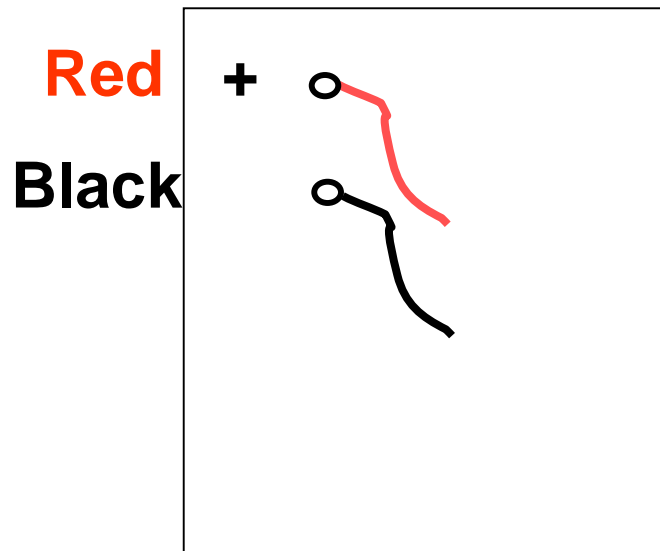
- 3) Place capacitors  
 C3 = 22 uf  
 C2 & C4 = .1uf

# Example Micro-Processor Controlled Counter Kit



4) Place Switches S1, S2 and S3 in their appropriate positions and solder.

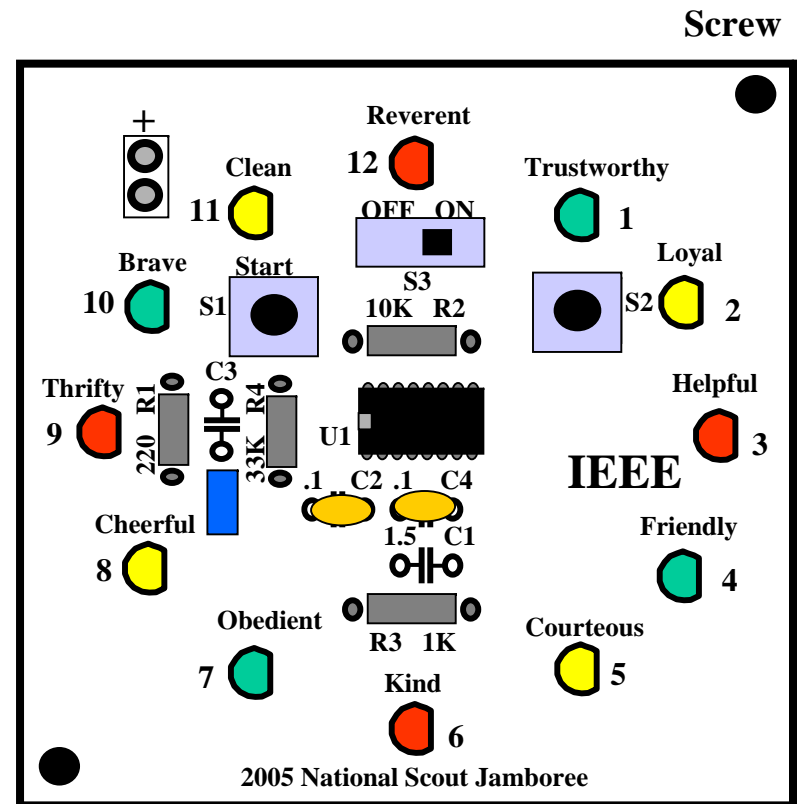
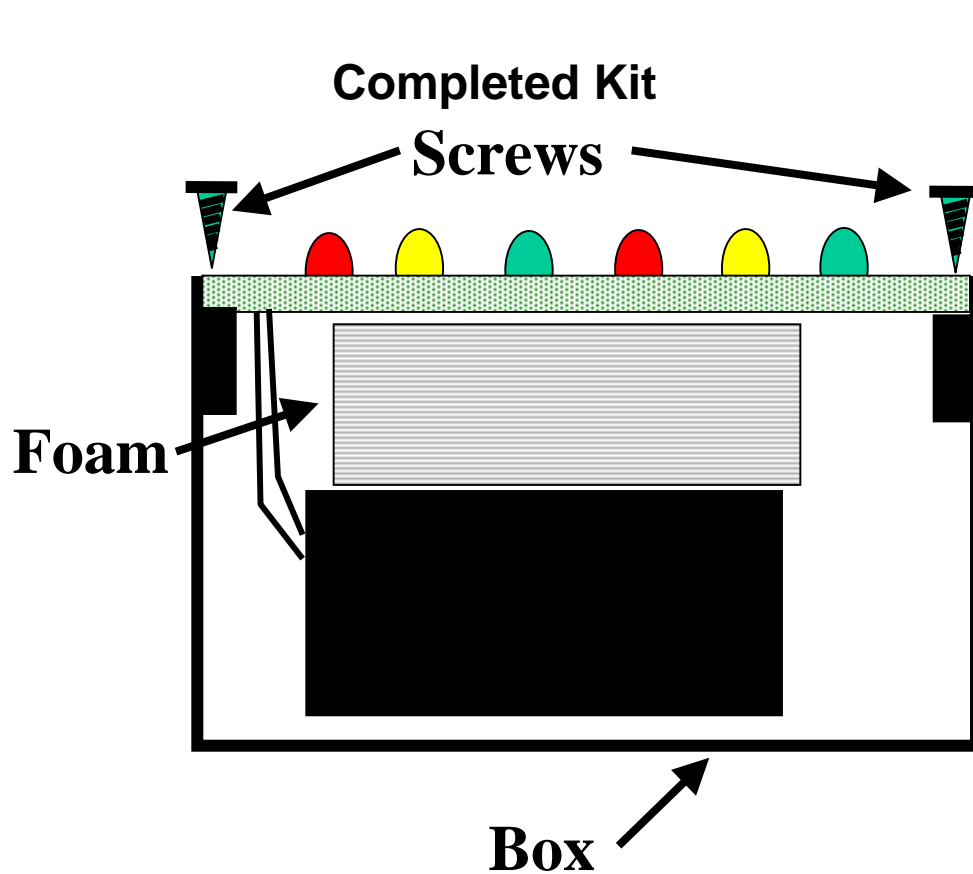
# Example Micro-Processor Controlled Counter Kit



- 1) The battery wires will be soldered to pads.
- 2) Heat up battery pads and melt a lot of solder on pad.
- 3) While pad is hot place wire to be soldered onto pad. The solder will flow to lead.

- 4) Connect the battery and turn on unit.
- 5) If unit does not work, review assembly for assembly errors.
- 6) Get help from MB Counselor

# Example Micro-Processor Controlled Counter Kit



- 1) Place Battery in bottom of box
- 2) Place foam on top of battery
- 3) Place PC board and push foam into box.
- 4) Use two screws on opposite corners.

Be sure to check the following websites for projects:

<http://www.apogeekits.com>

<http://www.hobbytron.com>

<http://www.bakatronics.com>

<http://www.electronickits.com>

Remember -

- 1) you must solder the kit
- 2) project must be a Control, and/or Audio, and/or Digital Circuit
- 3) project **MUST** be approved **BEFORE** building
- 4) project should be something that you are **INTERESTED** in to keep you going
- 5) don't begin with something super complicated