EL-K-Back and forth LED flasher
Assembly instructions
Version 1.1
Revised January 23, 2014

EL-K-Back and forth LED flasher kit flashes two different LEDs in an alternating pattern and is powered by a standard 9 Volts battery. The “on” time of each LED is adjustable using the on-board variable resistors.

Please make sure you have the following parts in your kit:

**Part list**

**Resistors**
R1, R2  1K ohm ¼ watt (brown-black-red or brown-black-black-black-brown)
R3, R4  10K ohm ¼ watt (brown-black-orange or brown-black-black-red)

**Variable resistors**
VR1, VR2  250K trimmer potentiometer

**Diodes**
D1, D2  Red T1¾ size

**Transistors**
Q1, Q2  NPN 2N3904

**Capacitors**
C1, C2  10μF at 25V electrolytic

**Hardware/Miscellaneous**
Qty. 1 x 9 Volts battery connector clip
Qty. 1 x printed circuit board (PCB)

Here is what the finished kit should look like once it is fully assembled:
Assembly and soldering

The word “install” means the following wherever it is used in this manual:

- Insert the part, oriented correctly, into its correct holes onto the component side of the printed circuit board (PCB).
- The component side is the surface that contains all the markings for the part placement.
- Bend the part's wires or tabs to hold it in place with the body of the part snugly against the top “component side” of the PCB.
- Solder all wires or pins of the part.
- Trim all excess wires extending beyond each solder connection, making sure wire trimmings fall away from the board and do not touch the PCB or any of it’s components.

1. Install R1, 1K ohm resistor (¼ watt, brown-black-red or brown-black-black-brown)
2. Install R2, 1K ohm resistor (¼ watt, brown-black-red or brown-black-black-brown)
3. Install R3, 10K ohm resistor (¼ watt, brown-black-orange or brown-black-black-red)
4. Install R4, 10K ohm resistor (¼ watt, brown-black-orange or brown-black-black-red)

Now we’ll install the electrolytic caps. Electrolytic capacitors have a right and wrong way to be installed based on polarity. Capacitors have a stripe or mark which indicates their negative lead. The PCB will show the positive side of the capacitor's installation hole. Be sure to place the (+) capacitor lead into the PCB (+) hole and the (-) lead into the (-) hole. Always observe correct polarity when installing the electrolytic capacitors.

5. Install C1, 10F electrolytic capacitor. Remember to watch the polarity.
6. Install C2, 10F electrolytic capacitor. Remember polarity!
7. Install Q1, the transistor marked 2N3904. The flat side must be placed as shown on the PCB. Mount it as close to the board as possible without forcing it.
8. Install Q2, the other 2N3904 transistor.

Next let’s install the two variable resistors (aka potentiometers). These are the components you can turn to adjust the “on” time of each LED.

9. Install VR1, 250K ohm trimmer potentiometer.
10. Install VR2, 250K ohm trimmer potentiometer.
11. Install D1, one of the red T1¾ sized LEDs. Being a diode, this part has a polarity and must be installed properly to work. You’ll see it has a flat side and so does the PCB silkscreen picture of the diode. The flat side indicates the negative lead. You’ll also notice that this lead is shorter than the other one.
12. Install D2, the other red T1¾ sized LED. Remember polarity!
13. The last step is to install the 9 Volts battery connector clip. The black wire from the clip goes to the hole in the PCB labeled “BLACK”. The red wire goes to the hole labeled “RED”.

Congratulations! You are now finished. Plug in a battery available at the instructor’s desk, adjust the two variable resistors, and see what happens.