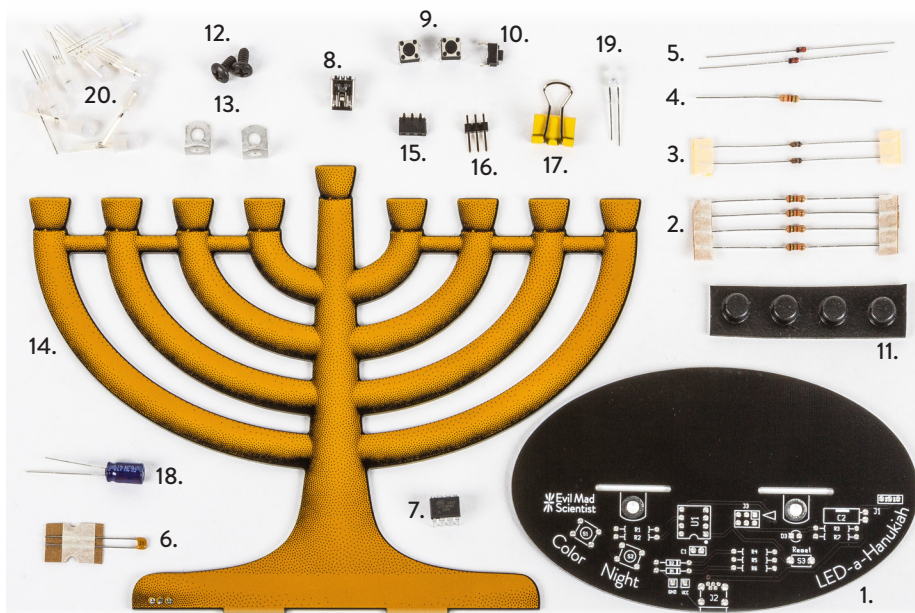# Mega Menorah 9000
RGB LED Hanukkah Menorah Soldering Kit
— Kit Assembly Instructions —

Evil Mad Scientist

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Kit Contents:

These are the parts that are included in the kit.

If anything is missing or broken, please let us know, and we'll get you squared away:
contact@evilmadscientist.com

1. ☐ Base circuit board
2. ☐ Resistor, 1.5 k (4)
3. ☐ Resistor, 68 ohm (2)
4. ☐ Resistor 5.1k
5. ☐ Zener diode, 3.6 V (2)
6. ☐ Capacitor 0.1 uF
7. ☐ ATtiny85 microcontroller
8. ☐ USB mini-B jack
9. ☐ Button switch, 4-pin (2)
10. ☐ Button switch, 2-pin
11. ☐ Rubber Foot (4)
12. ☐ Screw, 6-32 x ¼" (2)
13. ☐ Angle bracket (2)
14. ☐ Display circuit board
15. ☐ 3-pin angled header jack
16. ☐ 3-pin straight header plug
17. ☐ Binder clip, micro
18. ☐ Capacitor, 470 uF
19. ☐ LED, 3 mm diffused
20. ☐ RGB "Pixel" LEDs (9)
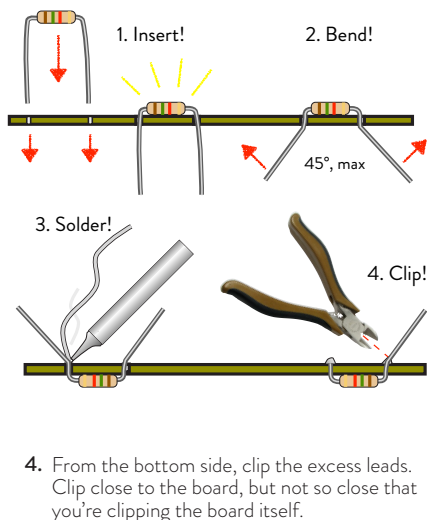
Required Tools and Materials: (not included with kit)
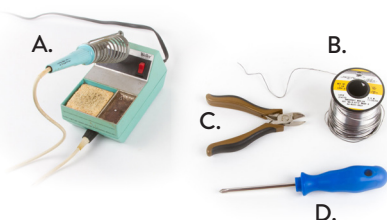
A. Soldering iron. Recommended: 25-50 W pencil type, e.g., Weller WLC100

B. Solder. Recommended: Rosin-core, 0.020 - 0.035" diameter

C. Small "flush" wire clippers, e.g., Sears Craftsman #45660

D. Phillips head screwdriver Ideally, "#2" size

E. USB A to mini-B cable

Basics:
How to Solder Components to a Circuit board

0. For resistors, pre-bend the leads as shown.
1. Insert a component at its given location. Push it down gently, as far as it will go.
   • Resistors should go down flush to the board.
   • Other components may not quite sit flush.
2. Gently bend its leads out, up to 45°, to hold the component in place while you solder.
3. One at a time, from the back side, solder the leads of the component to the circuit board.

   A. The tip of your iron needs to be shiny (tinned) for soldering to work well. If it isn't, melt some fresh solder against the tip and quickly swipe it clean against a wet sponge.
   B. Place the solder against the joint that you wish to connect.
   C. Touch the iron to the solder and joint for about one second. Count it out: "one thousand one."
   D. The solder should melt to the joint and leave a shiny, wet-looking joint. If not, let cool and try again.

1. Insert! **2. Bend!**
45°, max
3. Solder!
4. Clip!

4. From the bottom side, clip the excess leads. Clip close to the board, but not so close that you're clipping the board itself.

☐ Step 1: *Install the first four resistors*

Part #2 is a 1.5k resistor.
These are the four resistors on a strip; they have color code *brown, green, red, gold*.

Install them at locations **R1**, **R2**, **R3**, and **R6** of the base circuit board, using the instructions above. Resistors do not have a fixed polarity; they can be oriented either way.
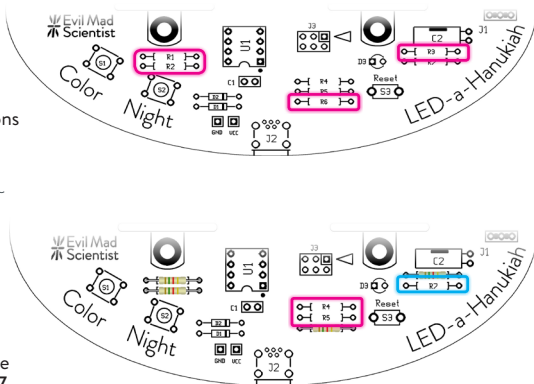
☐ Step 2: *Install remaining resistors*

Part #3 is a 68 ohm resistor.
These are the two small resistors on a strip; they have color code *blue, gray, black, gold*. Install them at locations **R4** and **R5**.

Part #4 is a loose 5.1k resistor with color code *green, brown, red, gold*. Install it at location **R7**.

☐ Step 3: *Zener diodes & 0.1 uF capacitor*

Part #5 is a zener diode. A small bead of glass, copper-colored, marked on one end with a black stripe.
Orientation matters: The black stripe end must match up with the stripe drawn on the circuit board. Install the zener diodes at locations **D1** and **D2**. Bend their leads like a resistor before inserting.

Part #6 is a 0.1 uF capacitor. A little yellow bead with two pins. Install it at location **C1**. Orientation: either way.

#5
#6
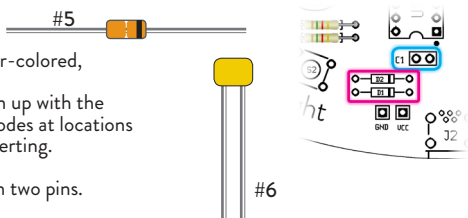
☐ Step 4: *Install Microcontroller*

Part #7 is the ATtiny85 microcontroller, a chip with 8 pins. One corner of the chip is marked with a little "dot" indentation.
Orientation matters: Insert the chip at **U1**, matching the corner with the dot to the dot drawn on the circuit board.

Once the chip is inserted, you can (gently, slightly) bend out its corner pins to hold the chip in place while soldering. Solder all 8 pins from the bottom side of the circuit board. Its leads are short enough that you don't need to clip them.

#7
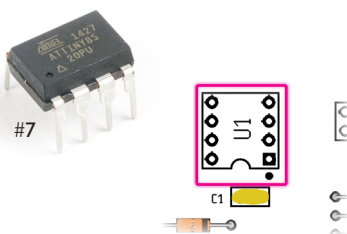
□ Step 5: *Install USB connector*

Insert **Part #8**, the USB jack, at location **J2**. This component has 9 pins in total: 5 small pins in the center and 4 wider ones on the sides. The pins cannot be bent (to hold it in place), but you can hold the board upside down against the jack to keep it level. (You could also use the binder clip.)

Solder one of the 4 side pins first. Then, check that the jack is level. And then, solder the other 8 pins. Inspect the soldering on the 5 center pins to make sure that each is soldered (and not connected to one another).
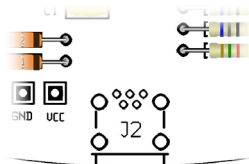
□ Step 6: *Tactile button switches*

Snap **Parts #9** and **#10**, the two 4-pin and 2-pin button switches, into locations **S1**, **S2**, and **S3**. Solder them in place. Their leads do not need to be bent or clipped.
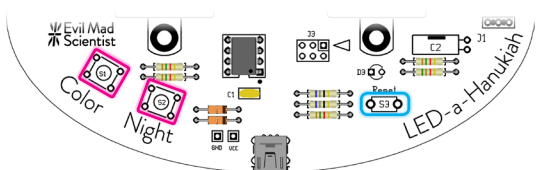
□ Step 7: *Rubber Feet*

Find **Part #11**, the self-adhesive rubber feet. Apply the four feet to the *bottom side* of the circuit board, in the four outlined circles. Press them firmly to secure them in place.
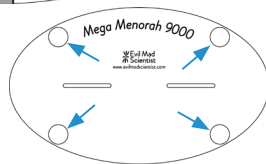
□ Step 8: *Add angle brackets to base*

Put a screw **#12** up through the wide hole next to one of the slots, and screw it into an angle bracket **#13** as shown. Tighten the screw only barely. Align the unthreaded face of the bracket against the slot. Repeat for the second screw and bracket.

□ Step 9: *Add 3-pin jack to display board*

□ **A.** On the circuitry ("back") side of **Part #14**, the Display circuit board, locate the 3-pin connector location on the lower-right foot. There are three holes and a marked-off rectangular area.
□ **B.** Place **Part #15** there, the 3-pin right-angle header jack. Orient it such that it fills the marked-off area, with the pins in the holes.
□ **C.** Solder the three pins in place from the other side of the board.
□ **D.** Locate **Part #16**, the 3-pin straight header plug, and slide it into the jack from below, long pins first. *Do not solder it into place.*

#14

#16

#15

§9D
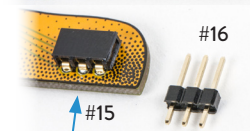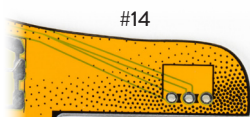
□ Step 10: *Mount the display board to the base*

□ **A.** Insert the display board into the base board, and press it flush. The tabs fit into the slots, and the pins of **Part #16** index into location **J1**.
□ **B.** Check that the two angle brackets sit flush against the Display board, when the Display board is vertical. If not, adjust the position of the angle brackets as needed and tighten the screws again.
□ **C.** Use **Part #17**, the binder clip, to clamp the Display board up to the left angle bracket as shown. Double check that the display board is vertical, level, and flush against the base board.
□ **D.** Solder the right angle bracket to the exposed pad on the Display board. Hold the soldering iron in contact with the upper part of the angle bracket (*not the circuit board*) for 10-15 seconds, until solder melts against the bracket. Then, bridge the gap between the bracket and the board with molten solder. Try to create several points of solder contact for strength.
□ **E.** Remove the binder clip. Solder the other angle bracket in the same way.

#17

§10C

§10D
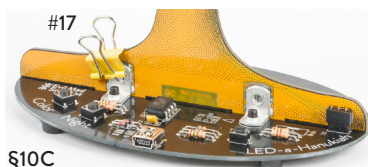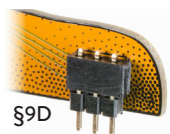
☐ **Step 11:** *Solder the three pins of J1 to the base board.*

☐ **Step 12:** *Last components on base board*

Part **#18** is a 470 uF capacitor. Its polarity is marked by a broad stripe on one side indicating the "-" side. With the stripe facing towards you, bend the leads down as shown. Install it at location **C2**. The stripe should line up with the drawing on the circuit board.

Part **#19** is a 3mm LED. Install it at location **D3**. Polarity: the long lead of the LED goes in the *squared* hole.

#18

#19

☐ **Step 13:** *Add the center flame*

Parts **#20** are the nine "Pixel" LEDs: RGB LEDs with built in driver chips.

☐ **A.** Bend the four leads of an LED outwards, spreading them apart very slightly as shown. Note that two leads are long and two are short.
☐ **B.** Identify the center "candle" position atop the Display board. Match up the long and short leads of the LED to its four exposed solder pads. Clip the LED in place as shown, flat against the board. Ideally, the clip should contact only three of the four leads, leaving the fourth free.
☐ **C.** Solder the bottom of the fourth lead to the board, to tack it in place. *Tip:* If you find the vertical soldering angle awkward, you can unscrew the display board from the base board, and re-attach it later.
☐ **D.** Looking from the front side of the Display board, gently adjust the LED position to be centered and level. The leads can be bent slightly.
☐ **E.** Solder the other three leads of the LED, and touch up the soldering on the first if necessary. These pins and pads accept solder very readily.

§12A

§12B

§12C

§12D

§12E
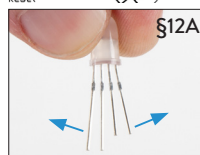
☐ **Step 14:** *Add remaining flames*

Solder the remaining LEDs in place, following the same procedures as in Step 13 for each LED. Add the LEDs in order *from the center out* on each side, so that the binder clip does not get stuck between LEDs. As you clip in each LED, also check that its height above the display board matches those already soldered.
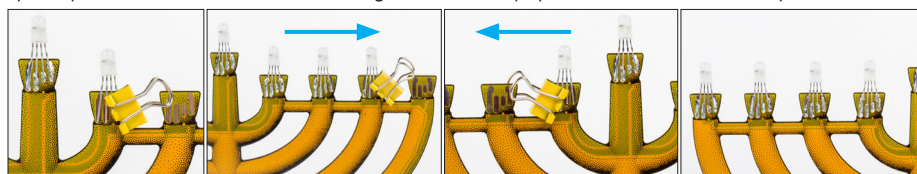
Step 15: *Plug it in!*

Mega Menorah 9000 requires 5 V power, and is normally powered through the USB jack. Most computers and USB chargers/power supplies will work to power it.

Basic operation:
Color button advances between color presets:
  14 solid colors, 10 mixed color and/or animated modes.
Hold Color to change brightness or flickering/steady display.
Night button (or resetting) advances Hanukkah night displayed.
Hold Night to put the LEDs to sleep. Press Night again to wake.

If you put the LEDs to sleep before disconnecting from power, it tends to start up more gracefully the next time.

The display board may be unscrewed and removed for storage.

Please visit our documentation site: http://wiki.evilmadscientist.com/mm9k for extended docs, resources, and programming information.