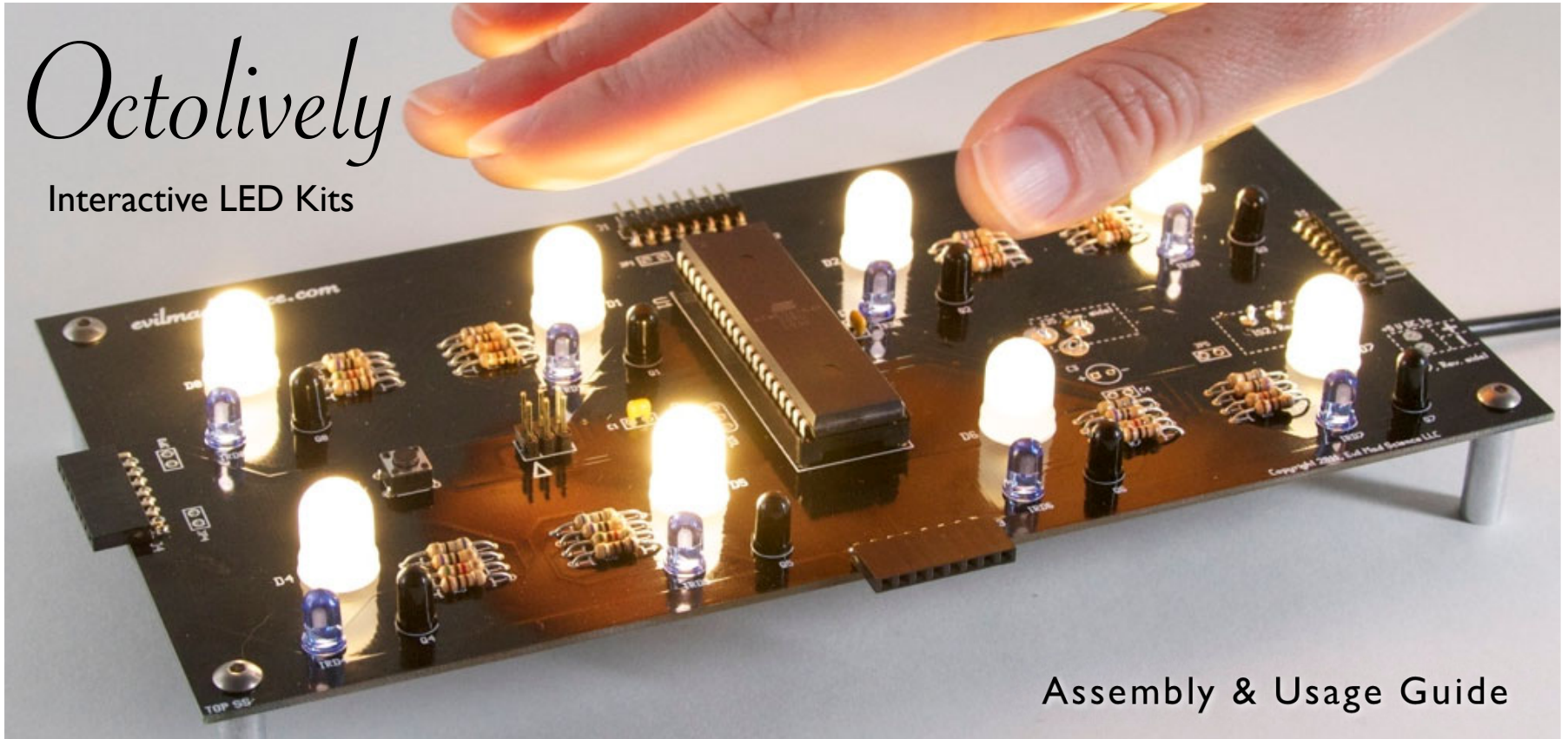


Octolively

Interactive LED Kits



Assembly & Usage Guide

This guide covers the assembly and usage of Octolively Interactive LED Kits. Please exercise appropriate safety practice while soldering and installing these kits.

An open-source hardware+software project. For design files, source code, & additional documentation, please visit: <http://wiki.evilmadscience.com/Octolively>

Support: <http://www.evilmadscientist.com/forum/>

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<http://evilmadscience.com/>



Kit version 1.0
Manual v. 1.0a

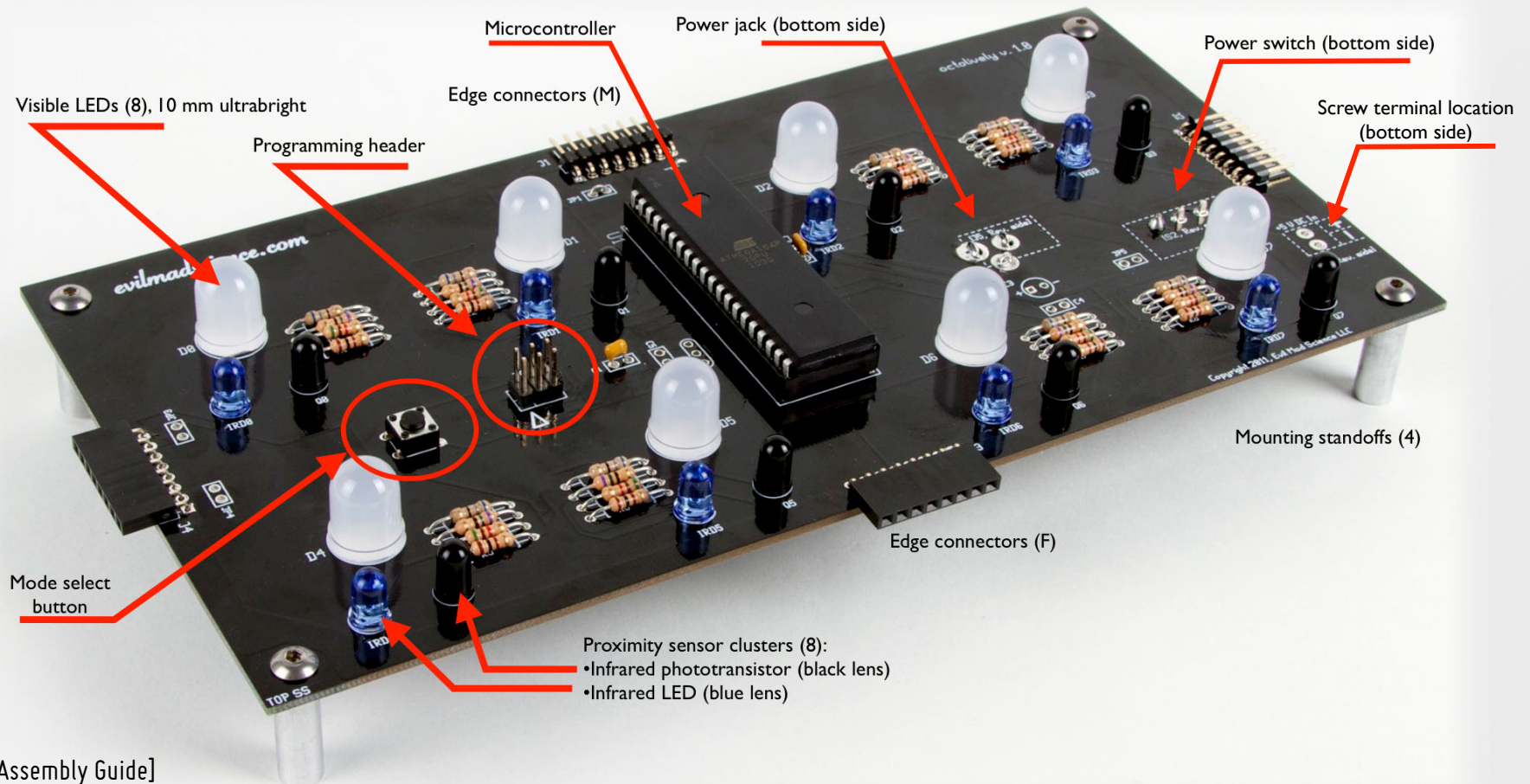
Introduction I – Octolively Anatomy and Overview

Octolively is a tileable, digital interactive LED module filled with ultrabright LEDs that respond in complex and gentle ways to stimulus provided by human interaction.

Each Octolively module is 4 X 8 inches in size, and features eight 10 mm ultrabright LEDs, spaced along a two-inch grid. Each Octolively module also has eight infrared proximity sensors—one for every LED—to detect nearby motion, even in total darkness. The modules can be tiled edge-to-edge, seamlessly, in any size or shape of rectangular array.

Octolively modules come pre-programmed with eight different effects that respond to motion and gradually fade back to idle when there is no motion, making them ideal for interactive LED walls, bar tops, and coffee tables. You can switch between the different effects with a button press.

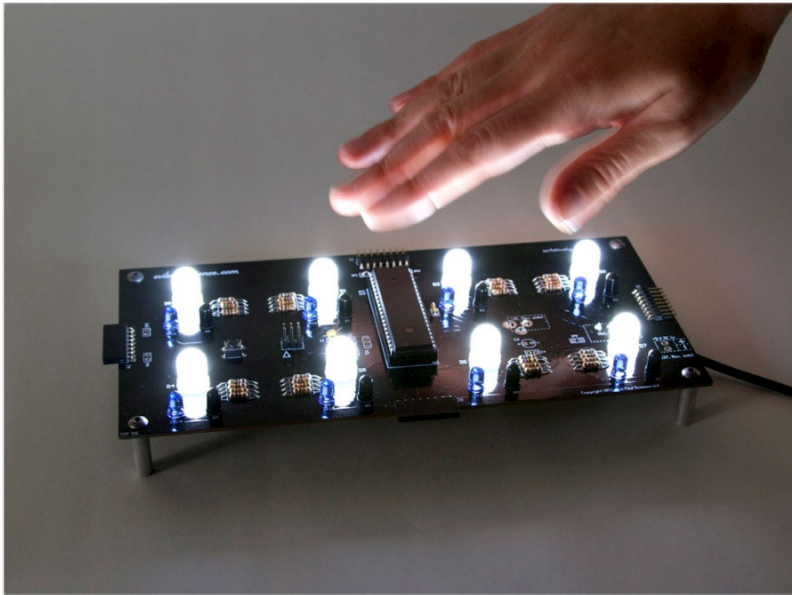
Each Octolively module is controlled by an on-board microcontroller and functions as a self-contained, stand-alone device. You do need to provide power (5 V DC), but no central computer nor programming is required.



Introduction II – Planning your installation: Powering Octolively, part I

Octolively modules require regulated 5V DC power to operate.

It is important to understand these power requirements, and to understand your options for providing that power before beginning assembly.



Octolively Power Supply Requirements

1. The power supply should have regulated 5V DC output.

Regulated power supplies keep their output within a few percent of 5V DC.

(Unregulated 5V power supplies may have voltage well in excess of 5V, often approaching 10V.)

2. The power supply must have current capacity of at least 200 mA (i.e., 0.2 A) per module that it powers.

For example, a single 5V DC, 1 A power supply can power up to five Octolively modules.

(Extra current capacity is not a problem; you can power 1, 2, 3, 4, or 5 modules from one 5V DC, 1 A power supply.)

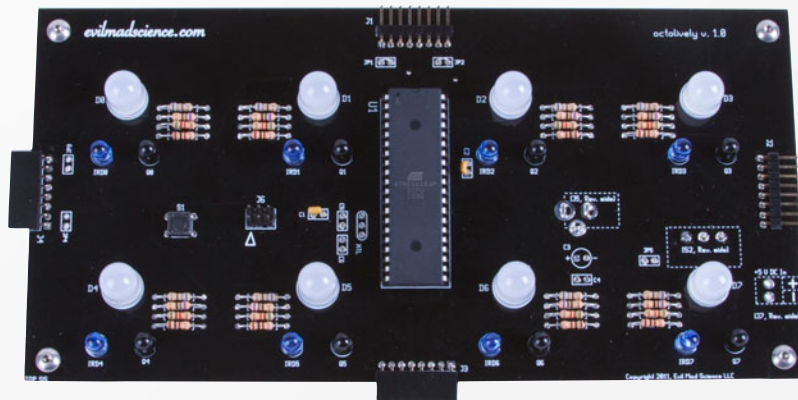
3. Each Octolively module should be connected to only one power supply at a time.

If you connect two different power supplies to one module at the same time, you are effectively connecting those two power supplies in parallel.

(That's usually a “no-no.” Do so only when explicitly recommended by your power supply manufacturer.)

Introduction III – Planning your installation: Powering Octolively, part II

Now that we've gone over the electrical requirements, how do you physically connect Octolively to your power supply?



The next few pages discuss the edge connectors and give recommendations for powering small, medium and large arrays of modules.

Ways to connect Octolively to your power supply

1. Power jack (2.5 x 5.5 mm, center positive)

Octolively kits are supplied with a high-current 2.5x5.5 mm barrel jack, that mounts on the bottom side of the circuit board. This can be used to connect directly to a suitable power supply: 5V DC, regulated, Center positive 2.5 mm plug.

2. Edge connectors

Octolively modules can connect to each other side-to-side through their edge connectors. For small arrays (or small sections of large arrays), these edge connectors can be used to share power between neighboring boards.

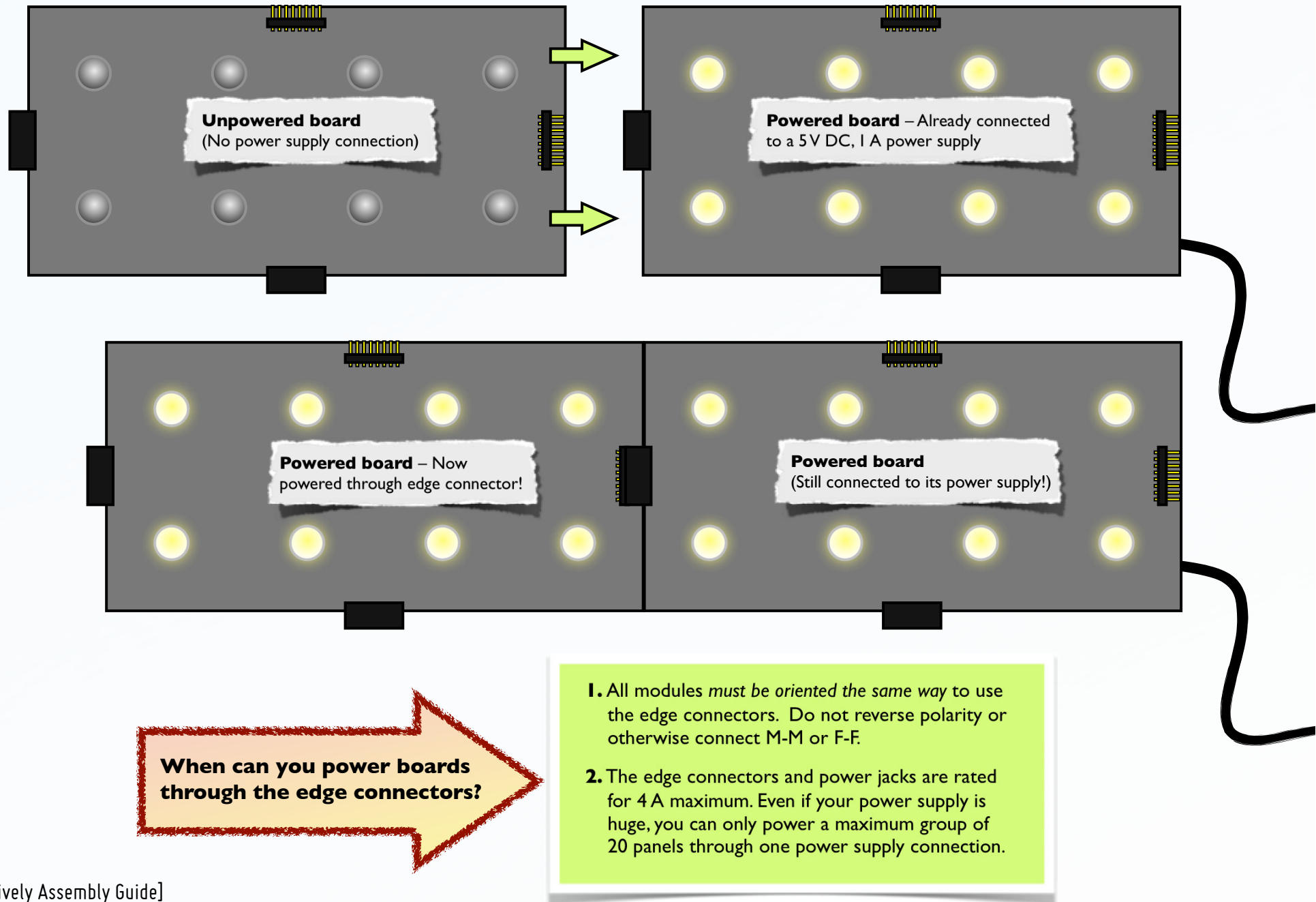
3. Screw terminals

Octolively modules feature a location for an optional two-position screw terminal that can be mounted to the bottom of the circuit board. If installed, 5V power can be connected to the modules through these screw terminals.

4. Hardwired power connections

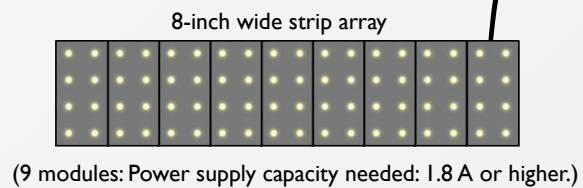
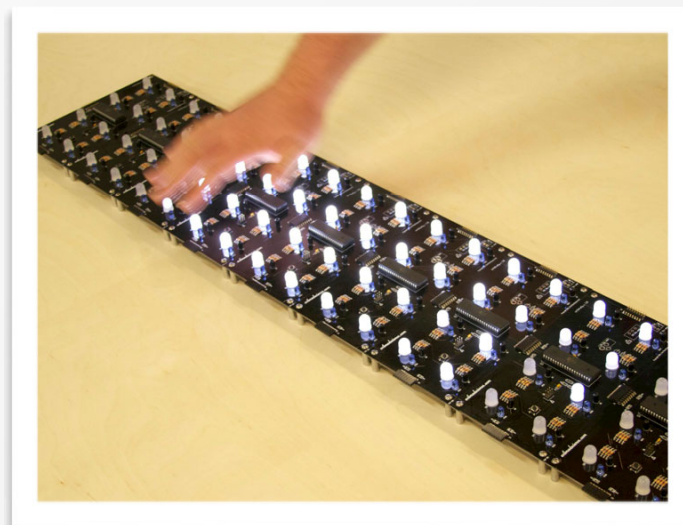
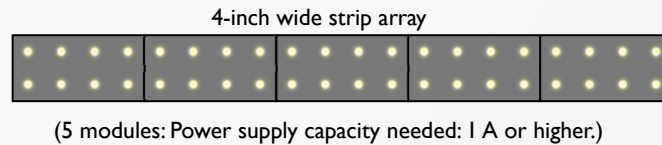
If the screw terminal is not installed, wires providing 5V power can be soldered directly into the location normally used for the screw terminals.

Introduction IV – Powering modules through Edge Connectors



Introduction V – Small arrays of Octolively modules

Small Octolively arrays— up to the capacity of a single power supply and consisting of 20 or fewer modules —can be powered with a single power supply connection and edge connectors.

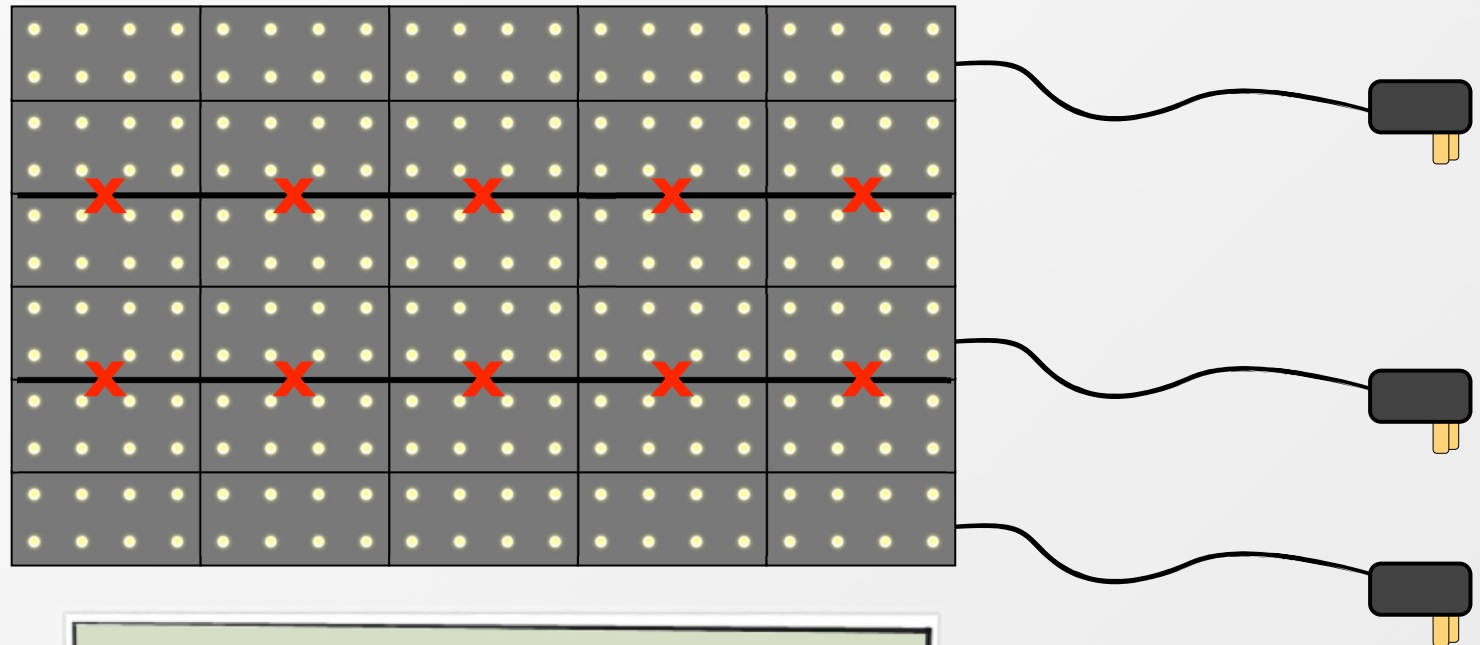


Larger-yet arrays can be constructed with 2D tiling

Introduction VI – Mid-size arrays of Octolively modules

For Octolively arrays too large to be powered from a single power supply, you can selectively disable (or simply not install) the edge connectors, splitting it small arrays, as in Overview 5.

Alternately, you may wish to follow the “Large array” methods from the next step (Introduction VII), entirely bypassing power from the edge connectors.



Example: This array of 30 Octolively modules is powered by three 5 V DC, 2 A plug-in power supplies. Each power supply drives 10 modules.

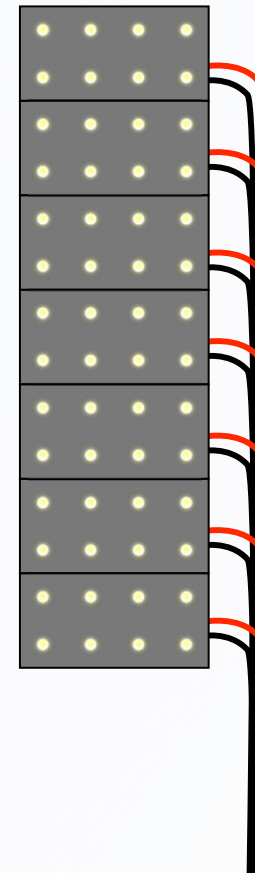
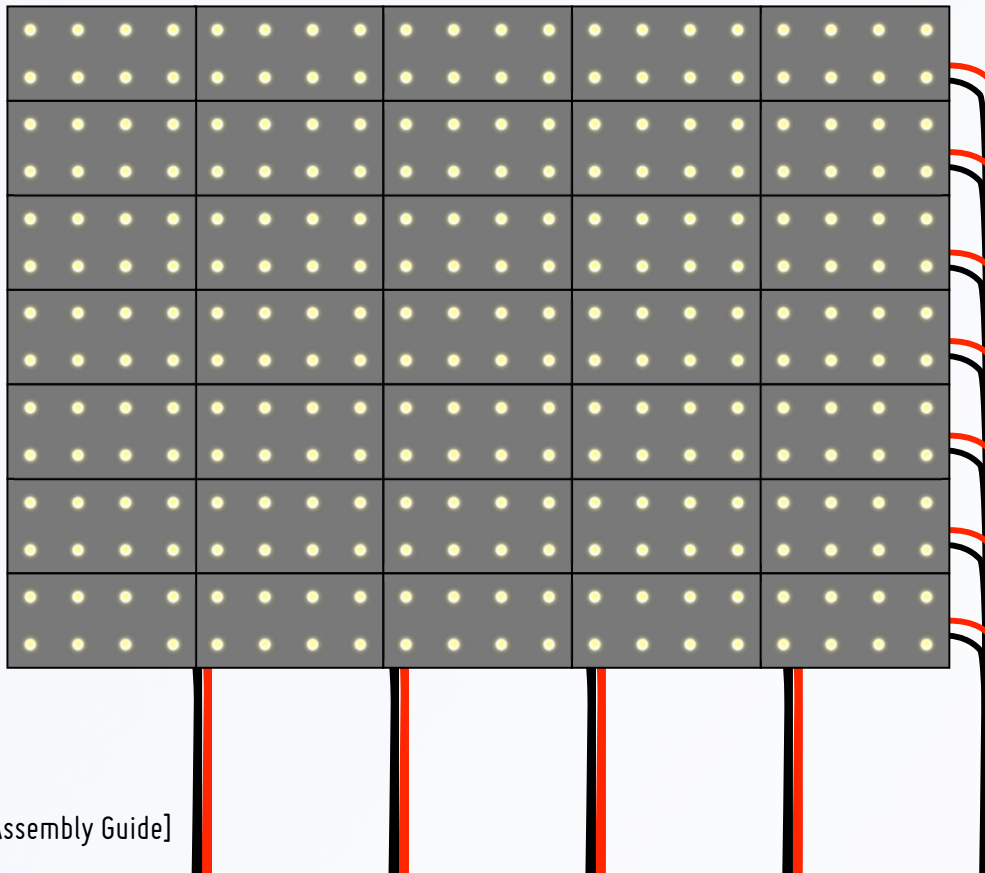
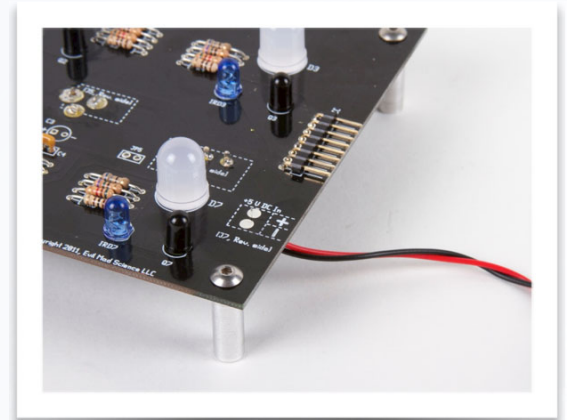
The modules are all connected together through their edge connectors, except where the connections have been disabled— the locations marked by with an “X.” (In a later step, we’ll show you how to disable those edge connectors.)

Introduction VII – Large arrays of Octolively modules

For large arrays and permanent installation, it may be preferable to run individual power wires to each module, attached either with screw terminals or directly soldered (hardwired) into place.

In this case, the edge connectors are disabled (or not installed), so that each module is only connected to power from a single source.

While the wiring in this case can become voluminous, it can be more straightforward, as an arbitrarily large array of Octolively modules can be powered, given a large enough 5V power supply.



Assembly Step I – Tool checklist

Octolively is a soldering kit. You'll need certain tools and supplies to build it.

Essential tools: Needed to build the kit:

1. Soldering iron

A basic soldering iron meant for electronics, with a reasonably fine point tip. We recommend one of this design-- a "pencil shape" soldering iron (not gun!) with a base that holds the iron and a wet sponge.

While you don't need an expensive one, the iron *can* make a big difference in the time needed to build the kit. (Seriously. If you use one that is old and busted, or an ultra-low-end \$10 iron, expect to spend at least twice as long soldering!)

Our recommendation for a low-cost iron:
WLC100 by Weller, about \$40.



2. Solder

Thin rosin core solder.

60/40 solder is easy to use; diameter of .025" or so is typical for work like this.

Either standard (lead-bearing) or newer "lead free" solder types will both work just fine.



3. Angle Flush Cutters

For clipping loose wire ends.

e.g., Sears Craftsman



Possibly helpful accessories; not required

1. Resistor lead forming tool

Allows fast, neat bending of resistor leads.



2. 5/64" Hex Driver

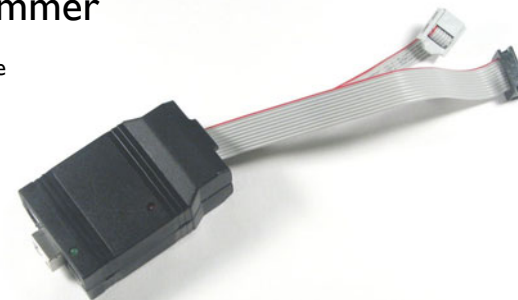
For attaching circuit boards to standoffs.

(Outside of the USA, a 2 mm hex driver will work nicely!)



3. AVR ISP Programmer

Such as the USBtinyISP, in case you would like to reprogram your Octolively boards



Assembly Step 2 – Line numbers and the BOM

Your kit comes with a *bill of materials*, the authoritative list of what's in your kit.

In the instructions, we refer to components by their line item number on the bill of materials. For example, **#19** is the Octolively's microcontroller.

In some places, the assembly procedure differs between kit versions.

In particular, note that some resistor values are different for kits with red LEDs versus those with blue, green, or white LEDs.

Octolively
by Evil Mad Science

Octolively Open source Interactive LED Kits
This document lists everything that comes with the kit.
If you find that anything is missing or broken, please let
us know right away and we'll get you squared away.
>>> contact@evilmadscience.com <<<

To build and use your kit, you'll also need instructions.
Get everything that you need at:
<http://wiki.evilmadscience.com/Octolively>

Kit version 1.0

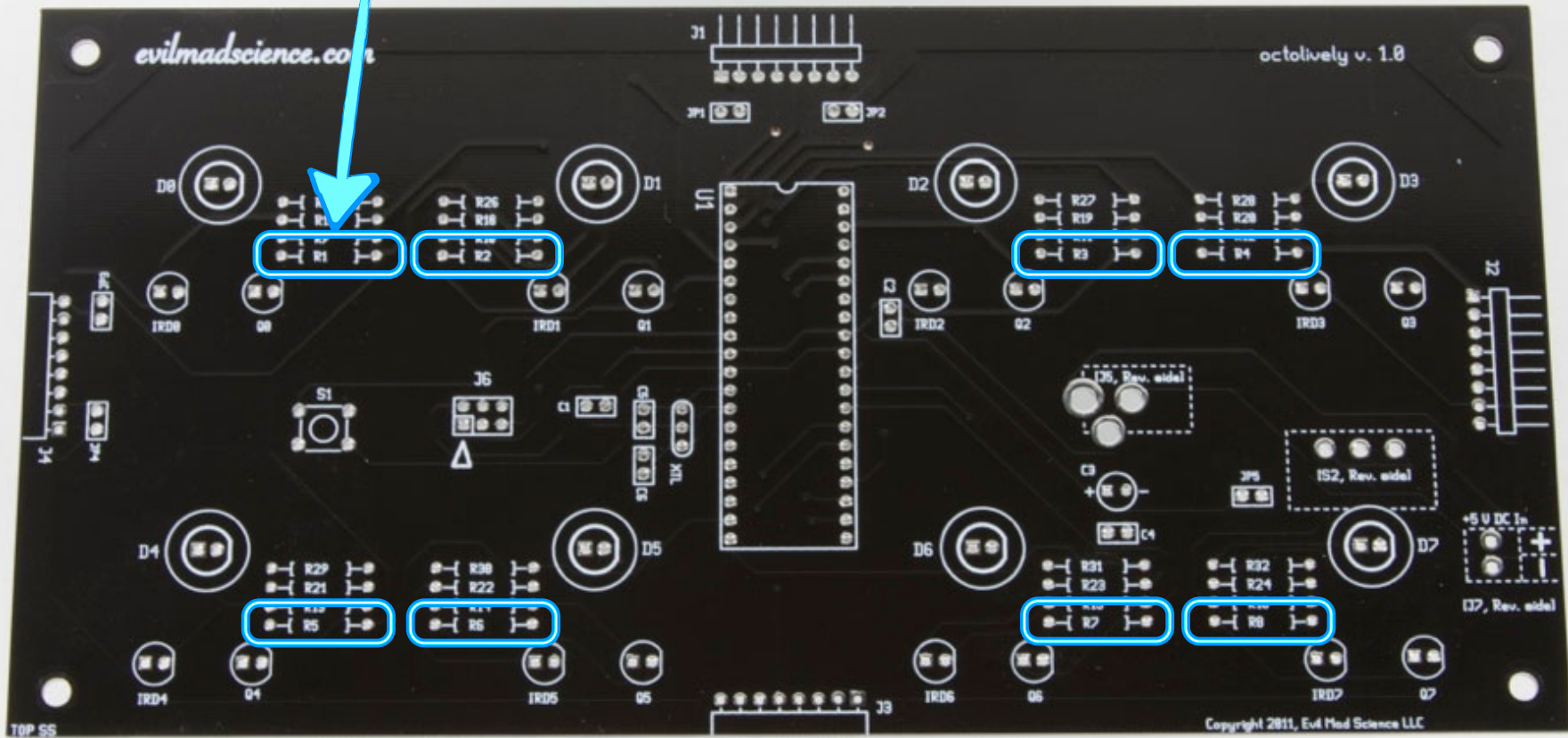
Octolively Soldering Kit: Bill Of Materials

Lin	Qty	Reference	Supplier	Part#
1	1	Circuit board, Octolively 1.0	Evil Mad Science	60-0029
2	8 R1-R8	Resistor, 100 Ohm	Digi-Key	100Q9K-ND
3	8 R9-R16	Resistor, 5.1 k Ohm	Digi-Key	51KQ9K-ND
4	8 R17-R24	Resistor, 75 Ohm	Digi-Key	75Q9K-ND
5	8 R25-R32 (Kits w/ Red LEDs)	Resistor, 220 Ohm	Digi-Key	220Q9K-ND
5	8 R25-R32 (Blue/Green/White)	Resistor, 82 Ohm	Digi-Key	82Q9K-ND
6	1 U1	IC Socket, 40-pin DIP, 0.6"	Digi-Key	1MS471-ND
7	1 J6	Header, 6-pin DIL	Digi-Key	609-3202-ND
8	1 S1	Switch, Tactile button	Digi-Key	5V-400-ND
9	8 Q0-Q7	Photoemitter, Infrared (black)	Digi-Key	160-1031-ND
10	8 D0-D7	BL-LS131RAB	Evil Mad Science	9330036
11	2 C1, C2	LED, 10 mm, choice of color	Evil Mad Science	BC1148TR-ND
12	1 S2	Capacitor, 0.1 uF Ceramic	Digi-Key	CKCS107-ND
13	1 J5	Power Switch, high power	Digi-Key	CP-003B
14	1 C3	Power Jack, 2.5x5.5 mm	Digi-Key	493-1040-ND
15	2 J3/J4	100 uF, 10V electrolytic cap.	Digi-Key	55483-ND
16	2 J1/J2	Edge Connector, Female 8 pos. female, gold, 0.100" right angle	Digi-Key	WH6108-ND
17	4 JP1-JP4	Edge Connector, Male 8 pos., gold. 0.100" right angle	Digi-Key	ZOR-25-R
18	1 U1	Zero-ohm jumper	Digi-Key	ATMEGA164P-20PU-N
19	4	ATmega164P, preprogrammed	Digi-Key	1488K-ND
20	4	Standoff, Aluminum, round, 6-32 x 3/16"	McMaster-Carr	92949A144
21	4	6-32 x 1/4" Stainless BSCS		

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Assembly Step 3 – First component locations

Our first assembly step will be to add components in locations R1 through R8 on the circuit board. Locate these 8 locations on your circuit board, as shown highlighted here.



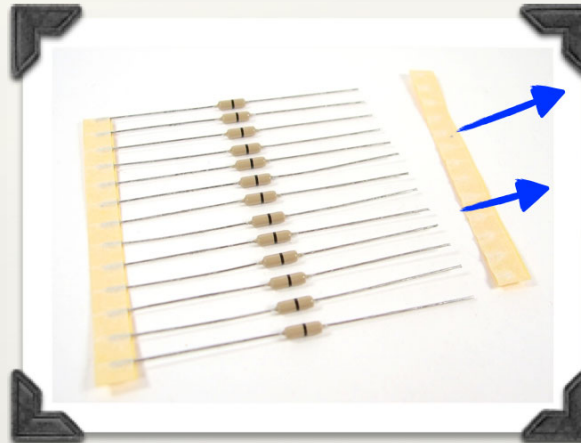
The Octolively circuit board, #1 on the bill of materials.

Assembly Step 4 – Find the first component

Our first component type is a 100 ohm resistor, **#2**. For this first one, we'll take it slowly.



Our first components are 100 Ohm resistors, **#2**. Identify them by their color code: Brown-Black-Brown-Gold



The resistors are normally taped together like the ones shown here. Pull the tape straight off to remove it.



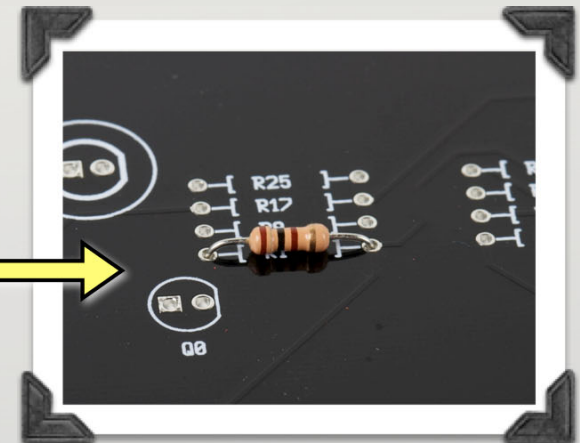
With the tape removed, you should now have 8 of these resistors.



Take one and bend it like so.



Insert it at location R1
(the orientation does not matter)



And press it flush to the board

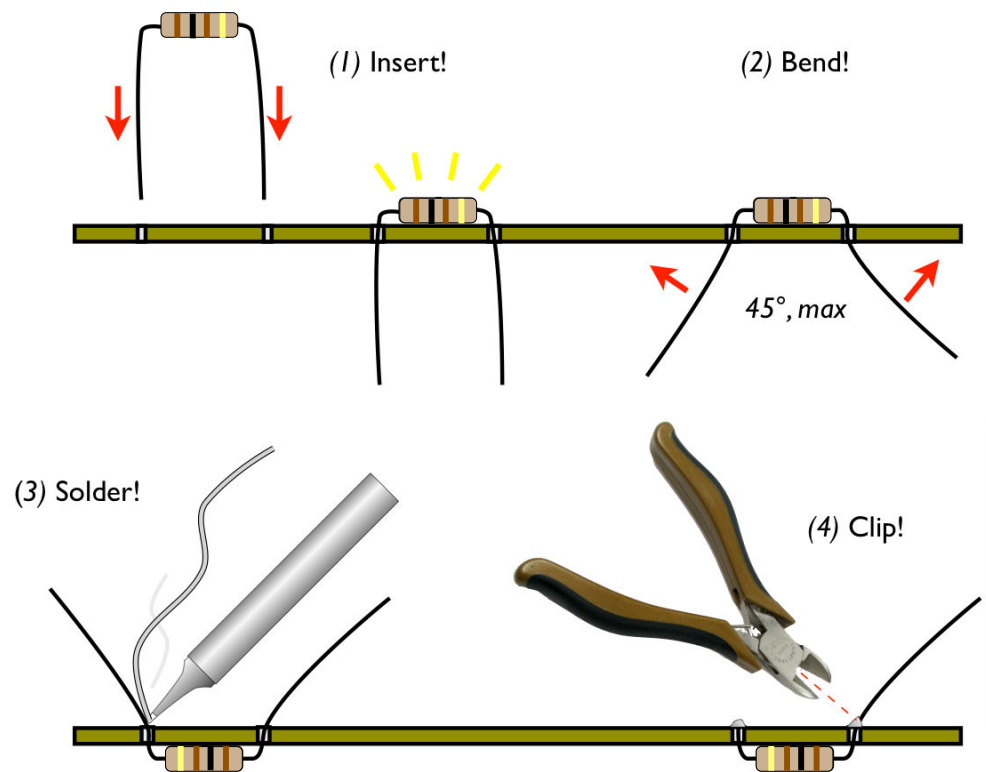
Assembly Step 5 – Some hints on soldering

As the old Heathkit manuals say, “it is interesting to note” that the vast majority of problems reported with soldering kits turn out to be due to unreliable solder connections.

Before we go further, here’s a quick refresher, with our suggested procedures for adding components to the circuit board. These procedures apply to most components in the kit.

Adding components to the circuit board

- (0). Pre-form the leads of components if needed.
(For example, like the resistor in step 4.)
- (1). Insert each component into the circuit board, from the top, at its given location. Push it flush to the board
(Note that some components, like the chip and LEDs, need to be inserted with a particular orientation.)
- (2). If your component has flexible leads, *gently* bend the leads out, up to 45°, to hold it in place while you solder.
- (3). One at a time, from the back side, solder the leads of the component to the circuit board.
 - Your tip *needs* to be *shiny* (tinned). If not, melt some fresh solder against it and *quickly* swipe clean on a wet sponge.
 - Place the solder against the joint that you wish to connect.
 - Touch the iron to the solder and joint for about one second. Count it out: “one thousand one.”
 - The solder should melt to the joint and leave a shiny wet-looking joint. If not, let it cool and try again.
- (4). If the component has long and/or flexible leads, clip off the extra length, close to the board. (But not so close that you’re clipping the board itself.)

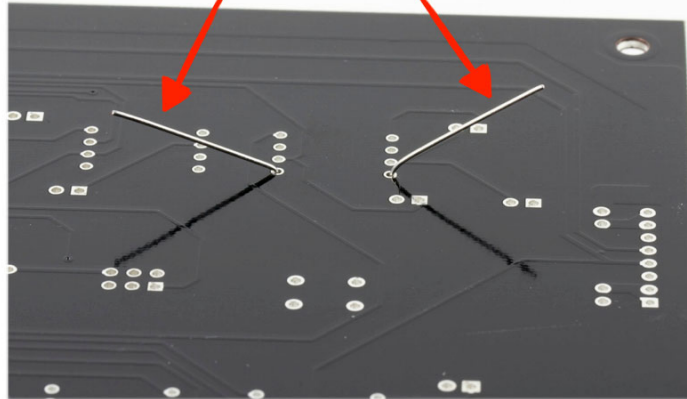


To be continued...

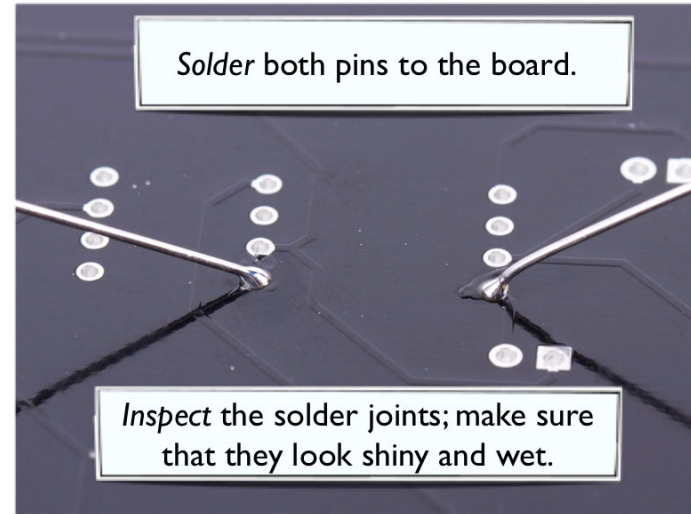
Assembly Step 6 – Solder that first resistor

(Where we perform those steps that we just described!)

Bend out the two leads of the resistor

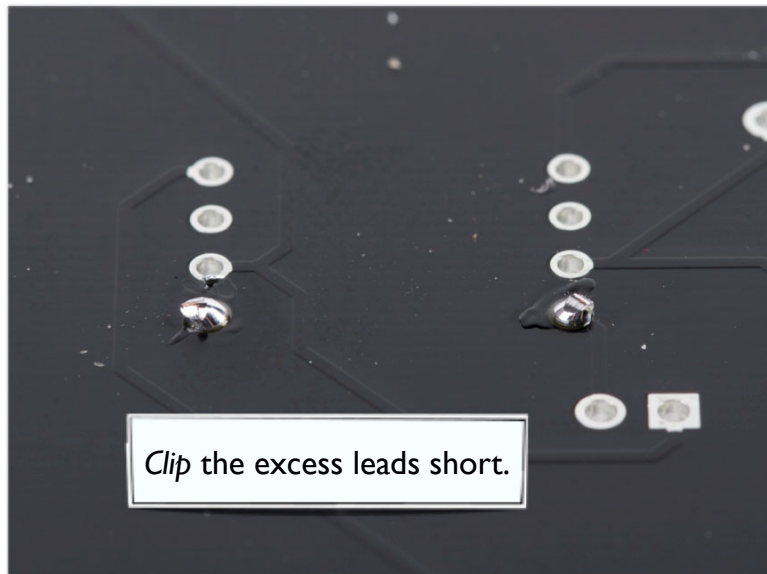


Solder both pins to the board.

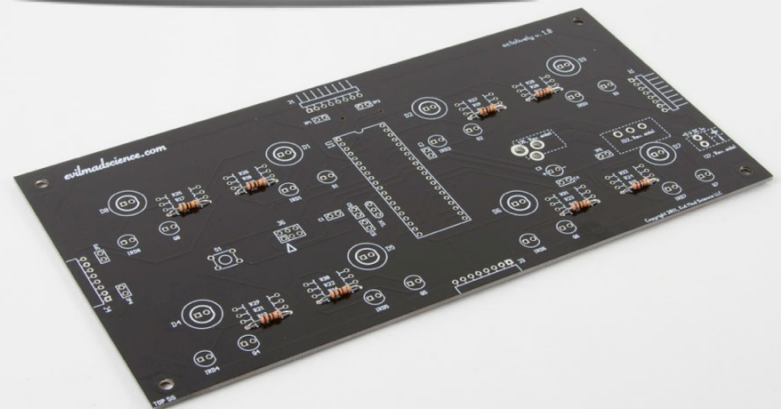


Inspect the solder joints; make sure that they look shiny and wet.

Clip the excess leads short.



Finally, *repeat* the procedure and install the other seven #2's in locations R2-R8.



Assembly Step 7 – Add the next two resistors

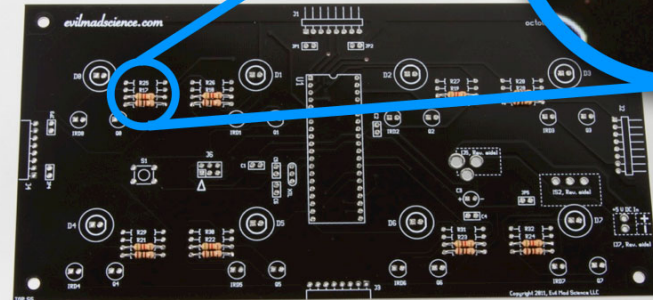


#3. 5.1 k resistors. Green-Brown-Red-Gold, 8 pieces.



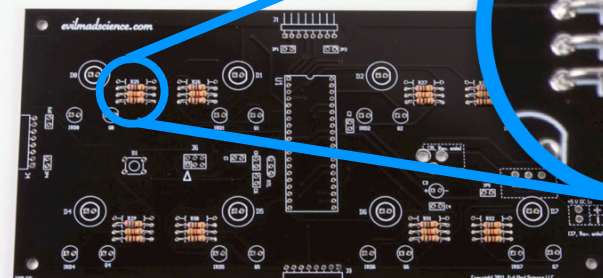
#4. 75 Ohm Resistors. Violet-Green-Black-Gold, 8 pieces.

Install **#3** in locations
R9-R16.



(Locations R9-R16 are “right above”
the last resistors that you installed.)

Install **#4** in locations
R17-R24

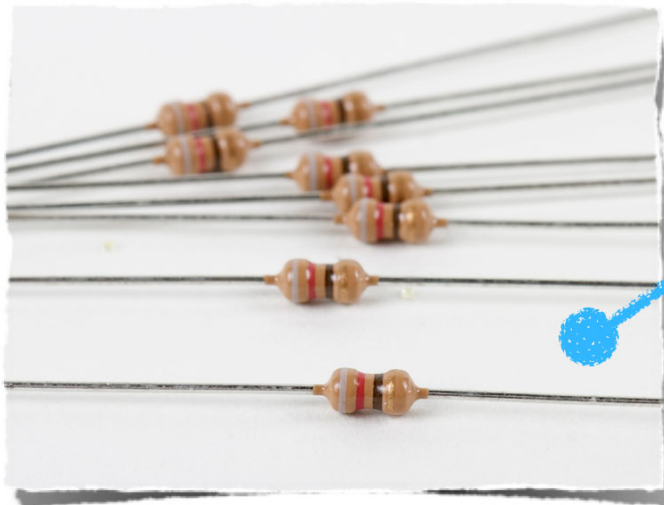


(As before, these locations are “right above”
the last resistors that you installed.)

Assembly Step 8 – Last resistors

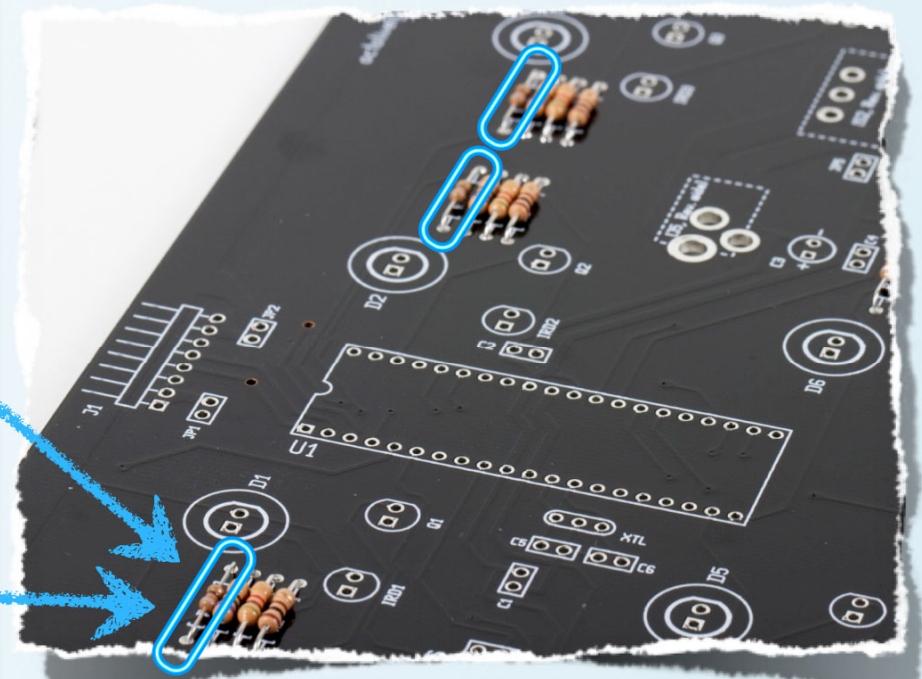


For kits with red LEDs, **#5** is 220 Ohm resistor, color code: Red-Red-Brown-Gold.



With other colors of LEDs, **#5** is an 82 Ohm resistor. Color code: Gray-Red-Black-Gold. (This is typically a smaller resistor, too.)

Part **#5** is a “load” resistor that sets the current through the visible LEDs. Its value depends on the LED color.

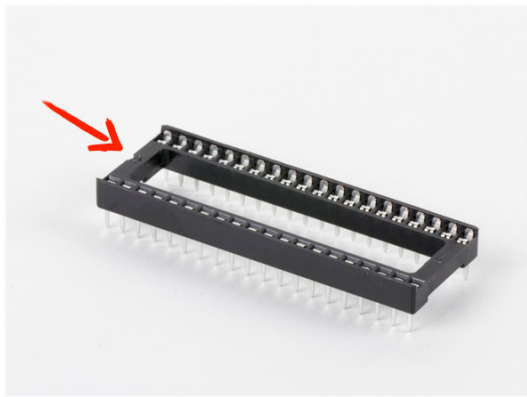


Depends
on
kit type!

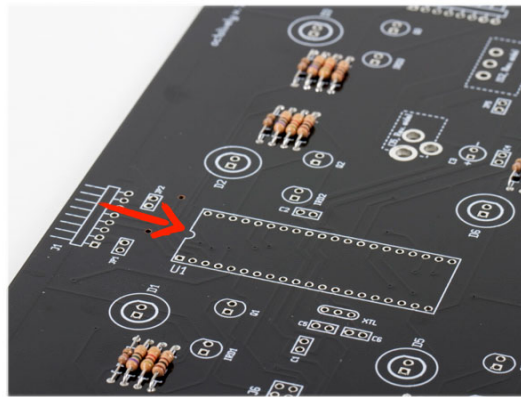
There are 8 resistors **#5**. Install them in locations R25-R32. This is the last resistor in each little block of four resistors.

Advanced tip: If you are using multiple LED colors on a single Octolively module, make sure that the resistor by each LED is the correct type: 220 ohm for red/orange/yellow/yellow-green, 82 ohm for blue/green/white.

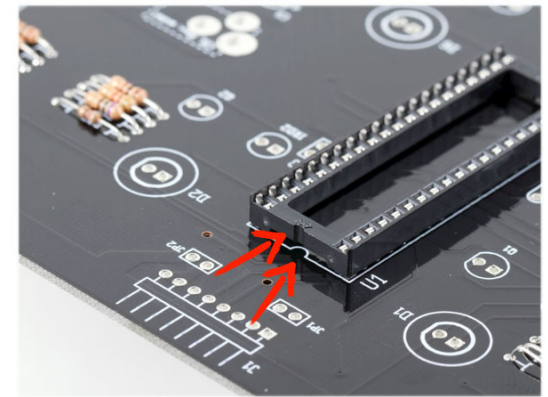
Assembly Step 9 – The IC Socket



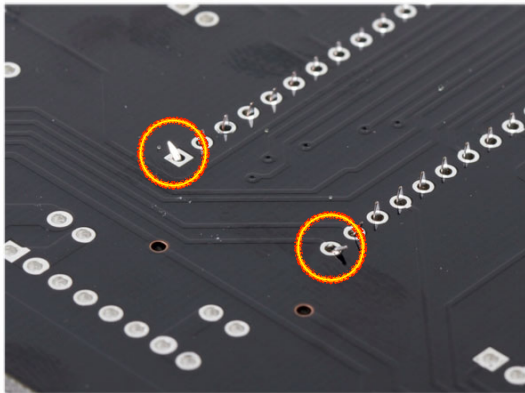
This is **#6**, the 40-position socket for the microcontroller. Locate the polarity marking notch at one end of the socket.



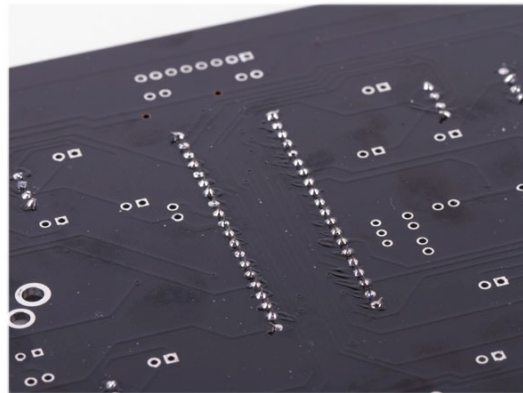
There is a corresponding footprint for the socket, at location **U1** on the circuit board. It has a corresponding notch at one end.



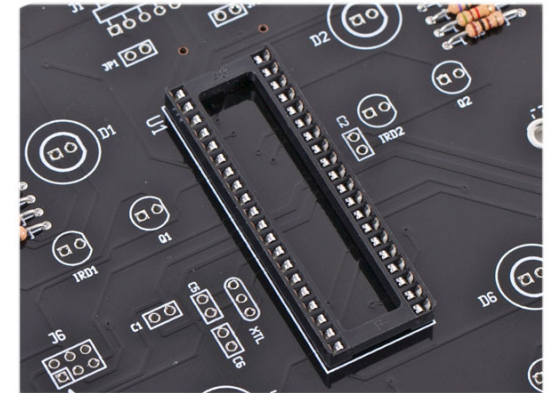
Insert the socket into the circuit board, matching the two ends with the notches.



On the bottom side of the circuit board, bend out the four corner pins of the socket, to hold it in place while you solder.



Solder all 40 pins of the socket into place. You can rest the circuit board flat on the socket while you solder.



Don't insert the chip just yet– we'll do that later.

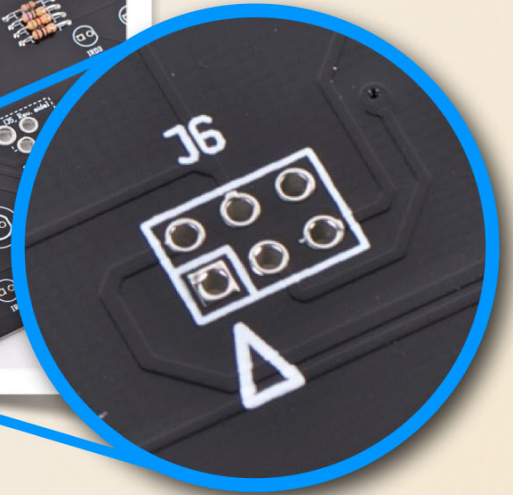
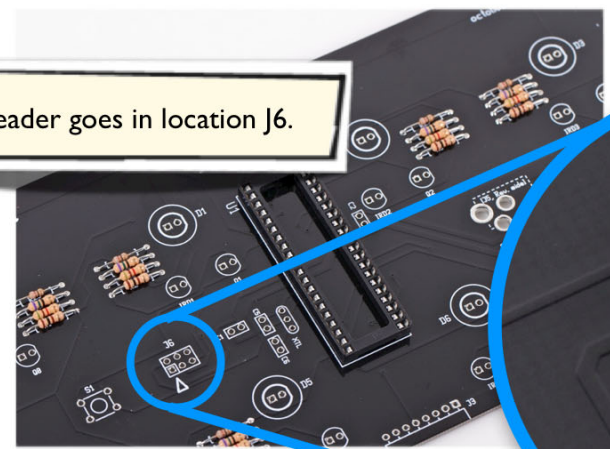
Assembly Step 10 – The programming header (optional)



Part **#7** is a 6-pin DIL (“dual inline”) Header.

This is an *optional* part, used for connecting Octolively to an AVR ISP Programmer. We recommend installing it, in case you wish to reprogram your modules at some point in the future.

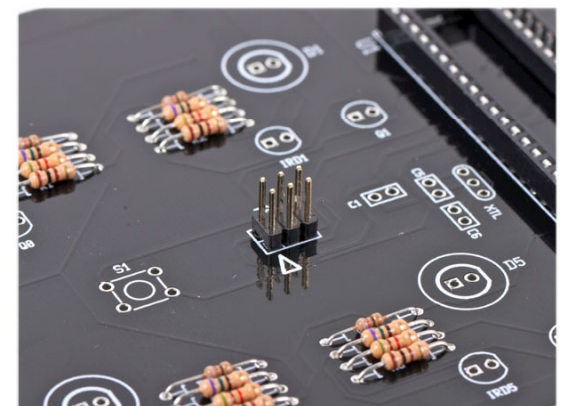
The header goes in location J6.



Header pins are short, and cannot be bent to them it in place. However, you *can* rest the whole board on the header to keep it in place while you solder; it's the tallest thing.

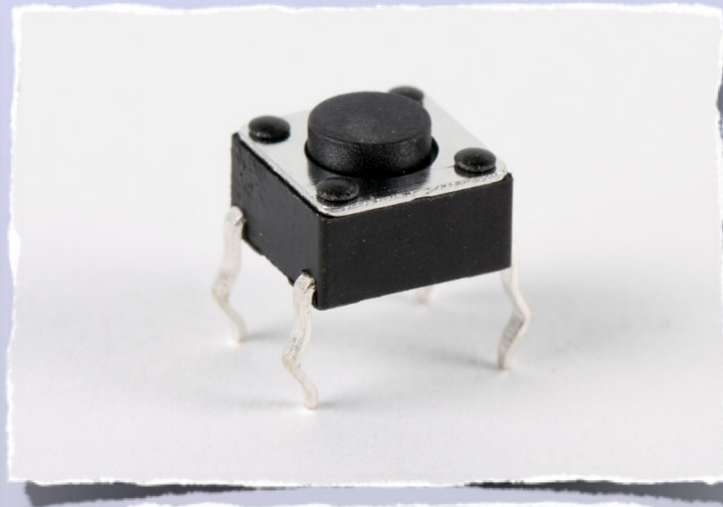


Pro-tip: To get the header straight, solder *one pin only* at first. Then check for straightness, before soldering the other pins.



Here's how it should look with all six pins soldered.

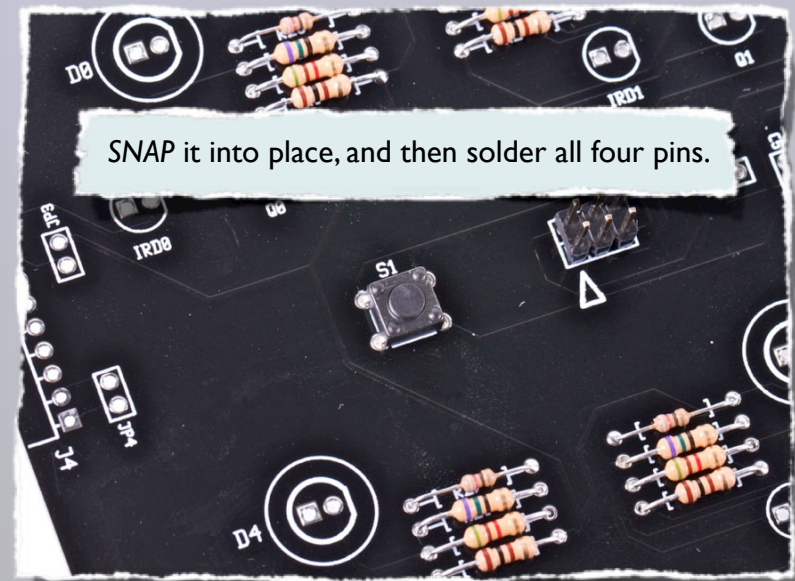
Assembly Step 11 – Tactile button switch



Part **#8** is a tactile button switch.



It goes in location S1.



SNAP it into place, and then solder all four pins.

Assembly Step 12 – Identify infrared components

Parts **#9** are infrared phototransistors. It looks like an LED with a black lens. There are 8 of these in total.

Parts **#10** are infrared LEDs with a transparent blue lens. There are 8 of these in total.

On both, notice that there is one *long lead* and one *short lead*.

Assembly Step 13 – Install infrared Components

#9, The blue infrared LEDs go in locations IRD0 - IRD7.

#9, The black phototransistors go in locations Q0-Q7.

For these parts, the *polarity matters*.
For both, the *long lead* goes in the *square hole*.

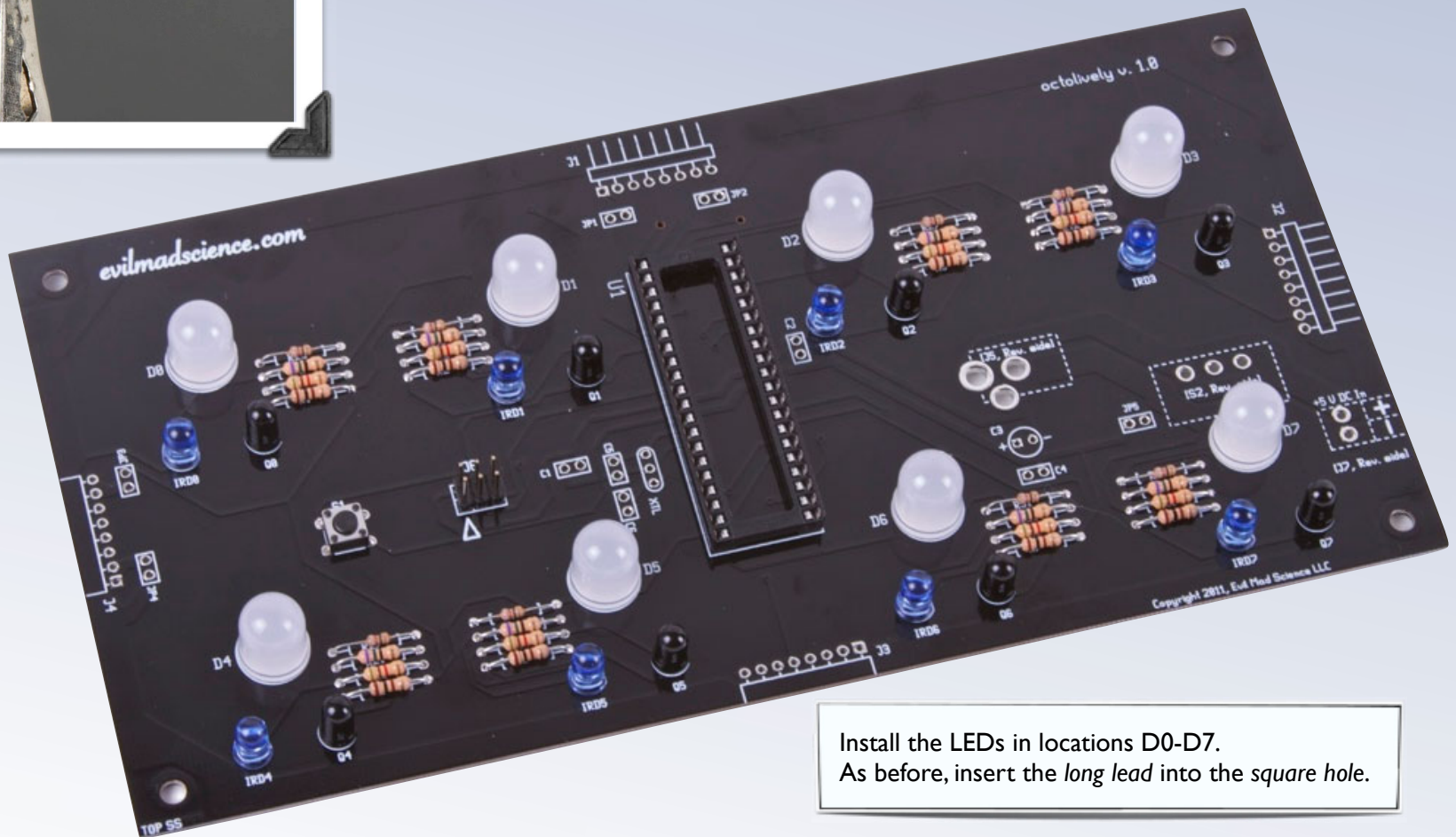
Install all 8 infrared LEDs and all 8 phototransistors flush to the board. Solder them in place and clip the leads.

Here's how everything should look so far, with the infrared components now in place.

Assembly Step 14 – Visible LEDs

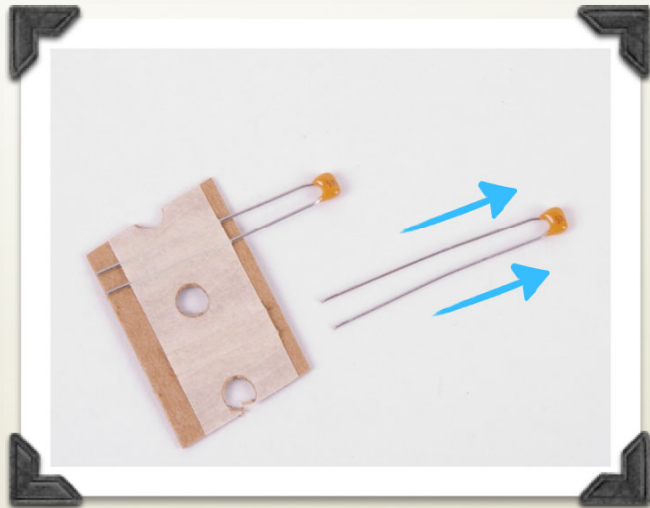


Next are #11, the 8 visible LEDs.
As with the IR components, each LED has one long lead and one short lead.

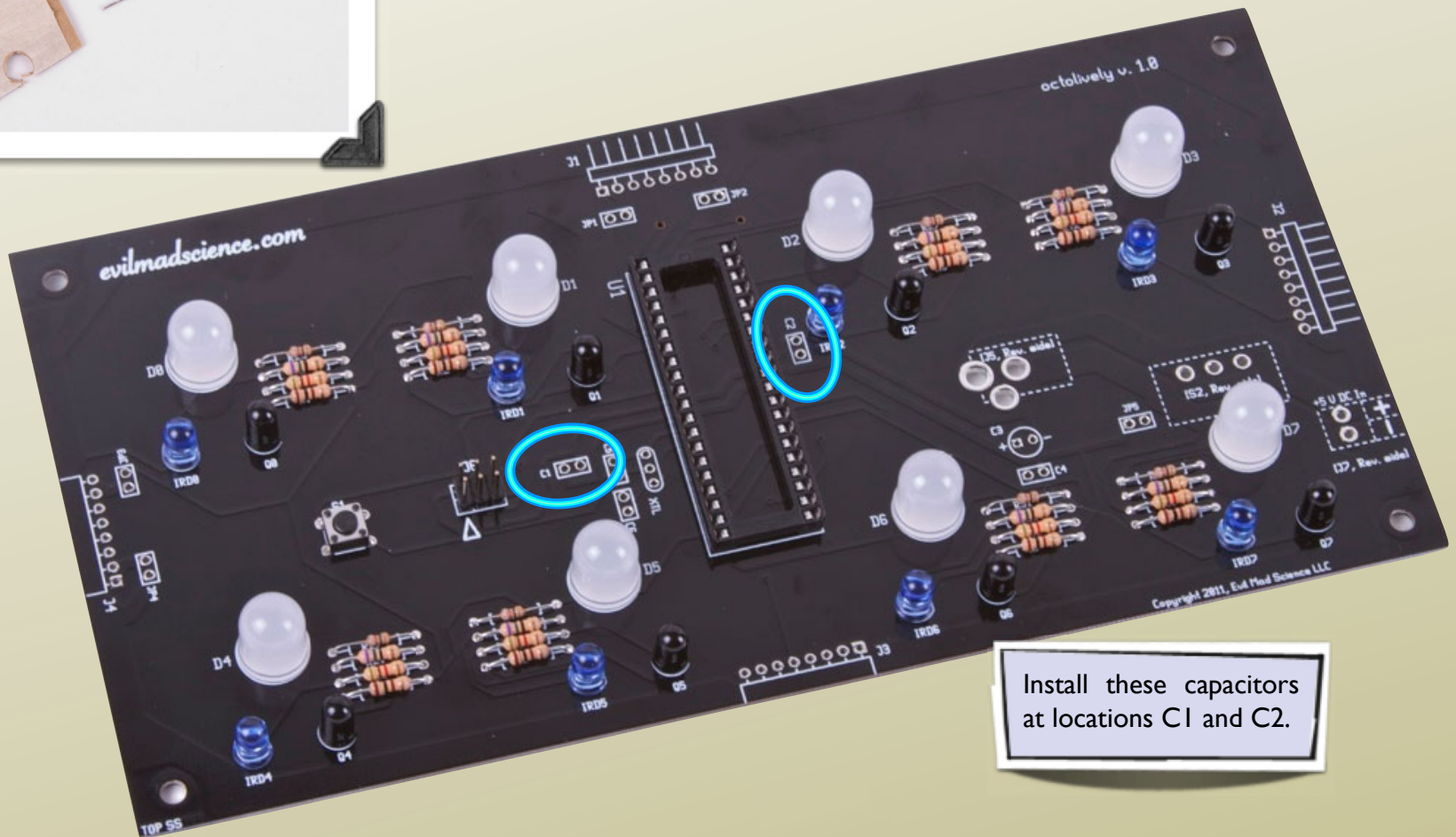


Install the LEDs in locations D0-D7.
As before, insert the *long* lead into the square hole.

Assembly Step 15 – Little capacitors

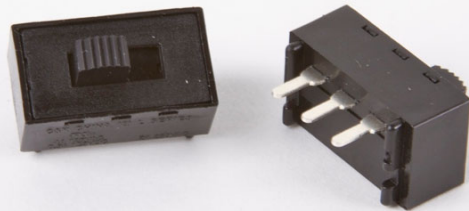


Parts **#12** are 0.1 μF ceramic capacitors– two little yellow blobs on leads. They come on tape, so pull them out.



Install these capacitors at locations C1 and C2.

Assembly Step 16 – Power switch, part I

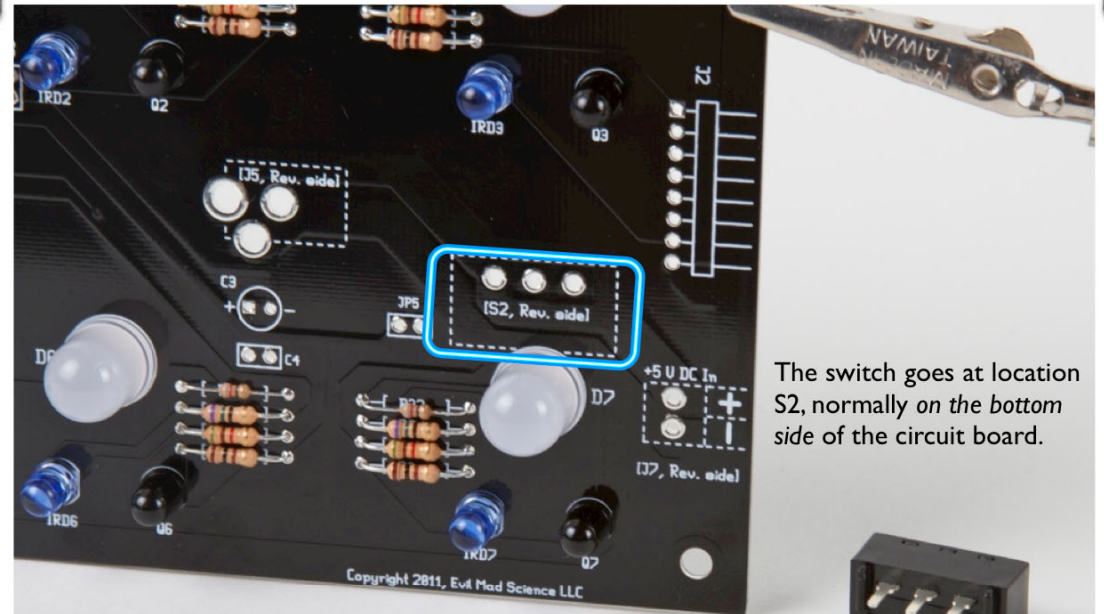


(There's just one power switch per kit; two are shown here for clarity.)

Part **#13** is a high-current slider switch.

In an array, you may not need to install this on every module.

- In the circuit, the switch sits between the power jack and the rest of the board.
- If you are powering an array, only the modules that will be connected to power actually need power jacks and power switches.

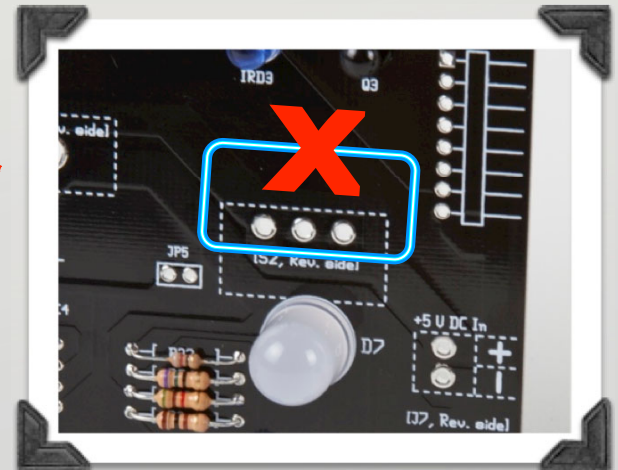


The switch goes at location S2, normally on the *bottom* side of the circuit board.

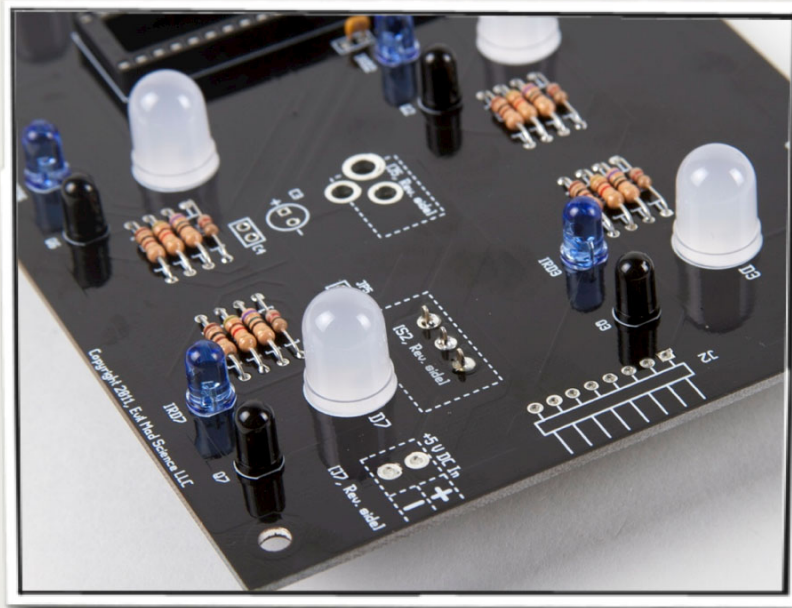
Orientation: Make sure that the switch sits under the dotted outline as shown above, not offset as shown below.

Like this!

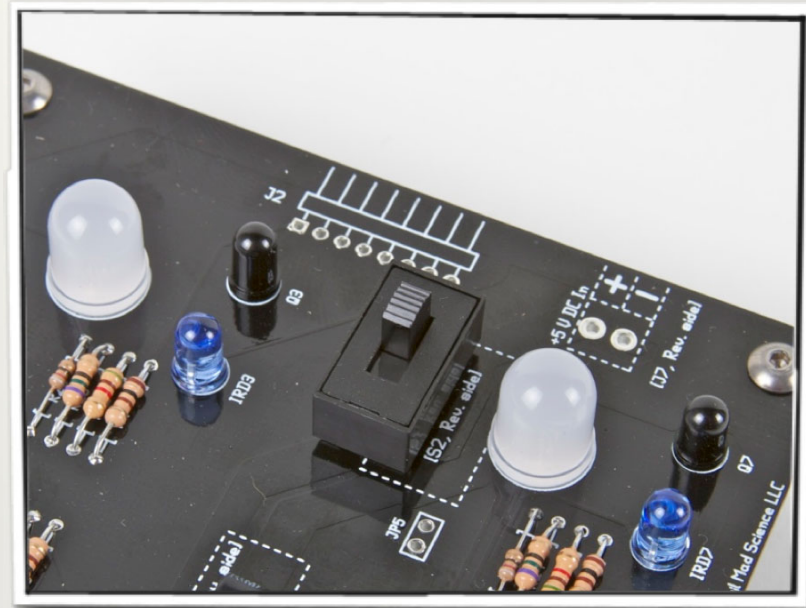
Not like this!



Assembly Step 17 – Power switch, part II

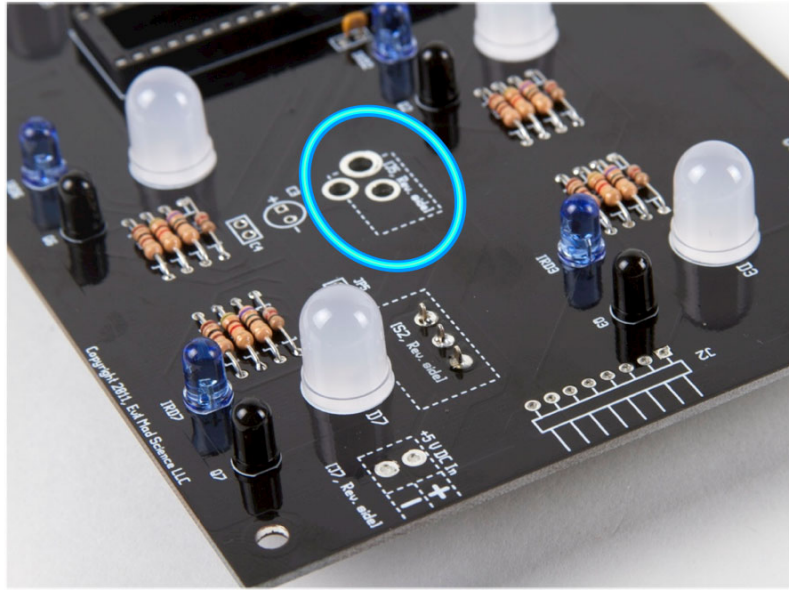


With the switch on the bottom side, solder the three pins of the power switch into place as shown.



If desired, you can instead install the power switch on the top side. If so, rotate it 180 degrees, so that it's *not* in the dotted line area.

Assembly Step 18 – Power jack



#14, The power jack goes in location J5, on the bottom side of the circuit board.

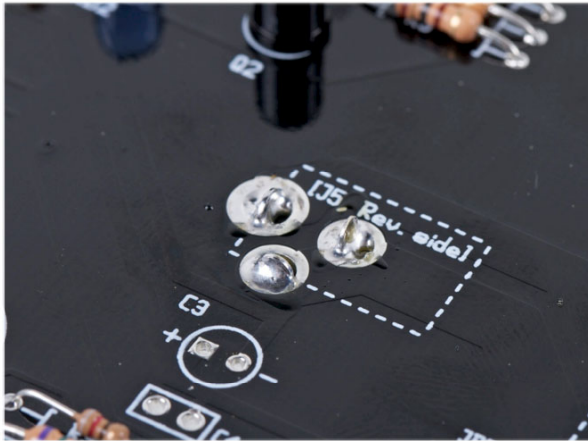
(As with the power switch, you may not need a power jack on every module.)



The power jack is located very close to the power switch.

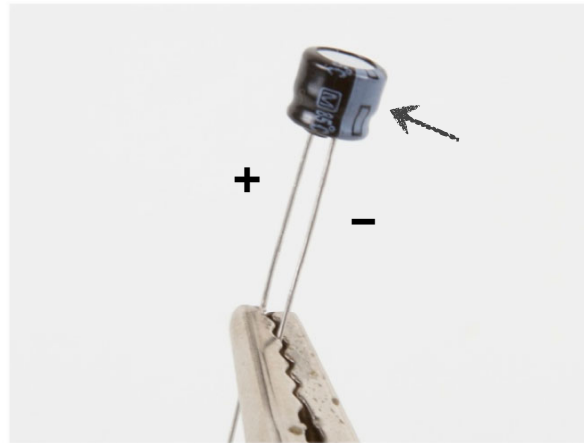
- To prevent the end of the power cord from potentially bumping into the switch, it is helpful to rotate the power jack several degrees in the direction indicated by the arrows.
- To do this, you may want to solder the jack with the power connector plugged in (but not connected to power).

Assembly Step 19 – Electrolytic Capacitor



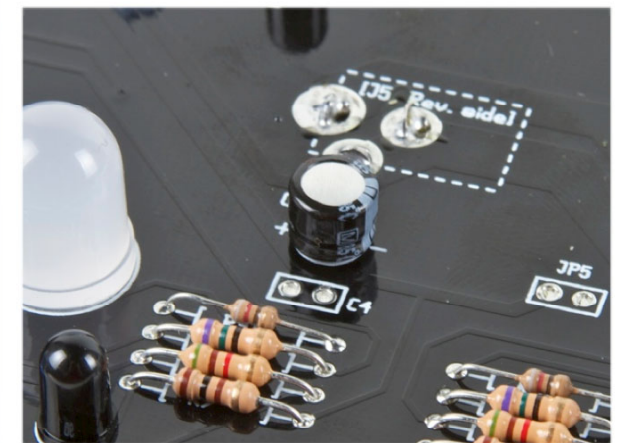
Solder the three pins of the power jack. It should make a solid connection, but it is not important to completely fill the holes with solder.

Our next component will go nearby in C3. Note that location C3 has its polarity marked on the board.



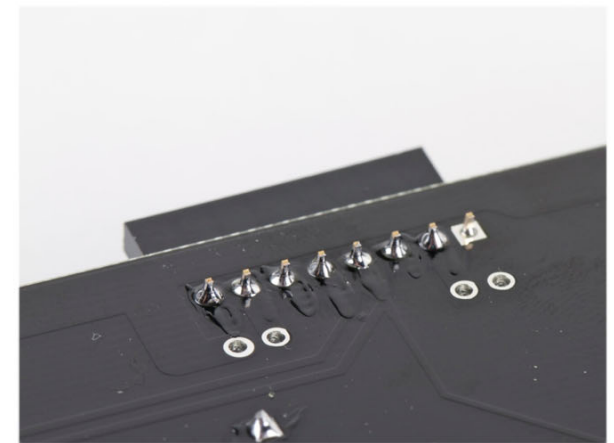
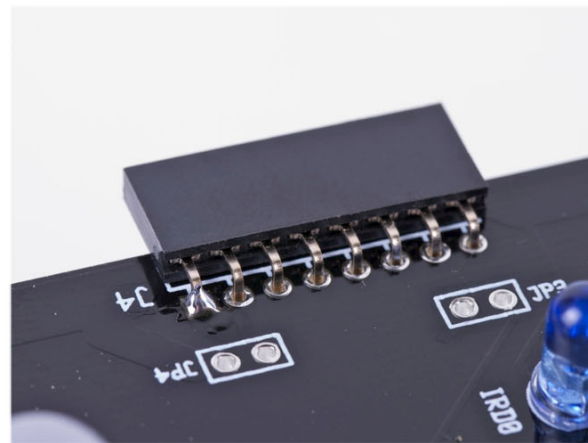
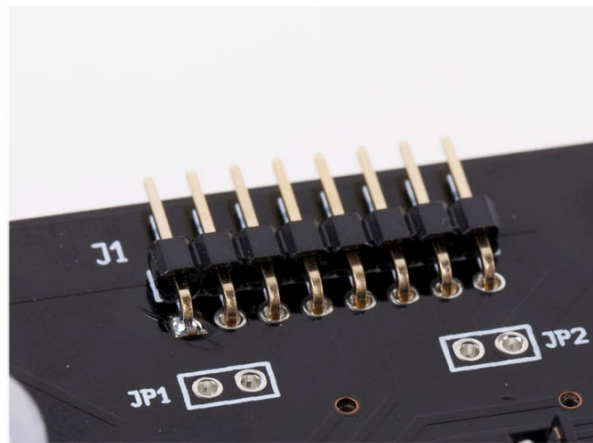
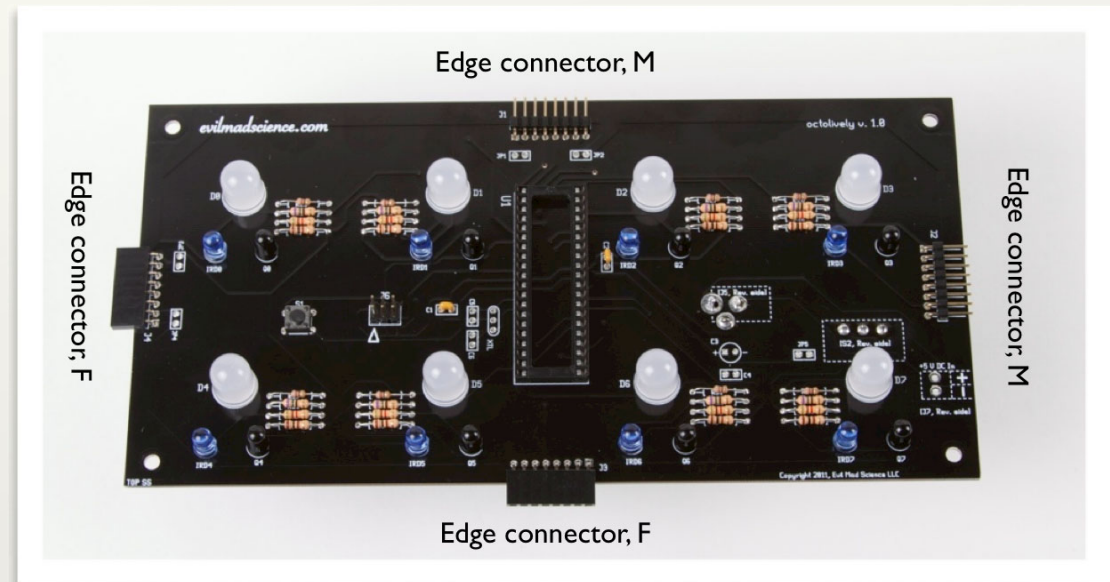
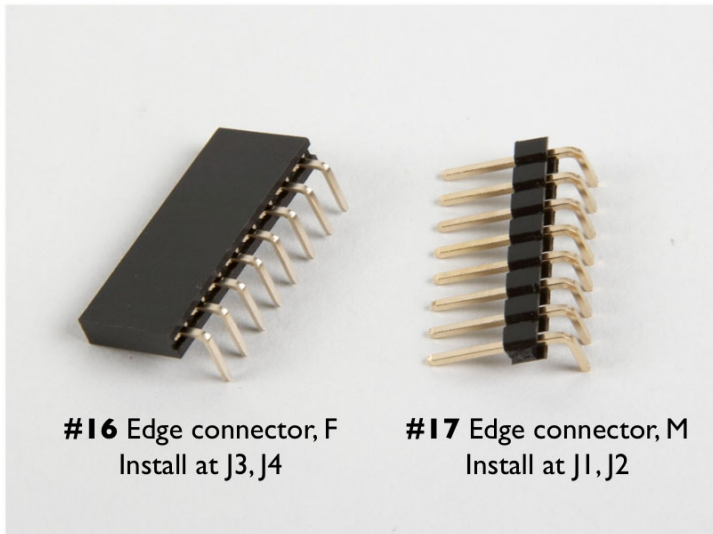
Our next part is **#15**, a 100 µF electrolytic capacitor, which goes in location C3.

This capacitor has a polarity: The “-” side is marked with a broad white stripe.



Install the capacitor at C3, matching the polarity to that indicated on the board, negative side to negative side.

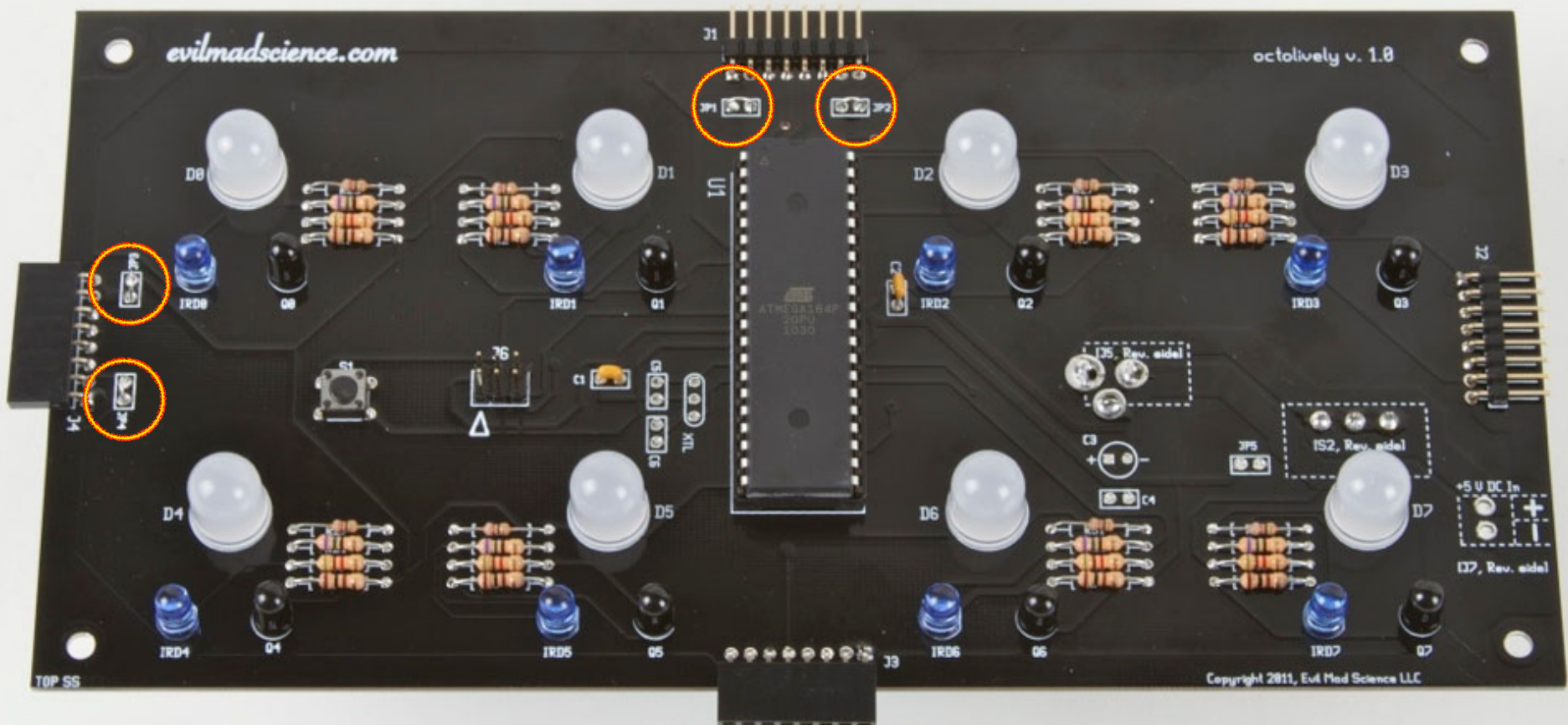
Assembly Step 20 – Edge connectors, part I



To get each edge connector straight and level: First solder one pin from the top to “tack” the connector in place. Check for straightness. Then, solder the other 7 pins from the back side.

Assembly Step 21 – Edge connectors, part II: About power jumpers

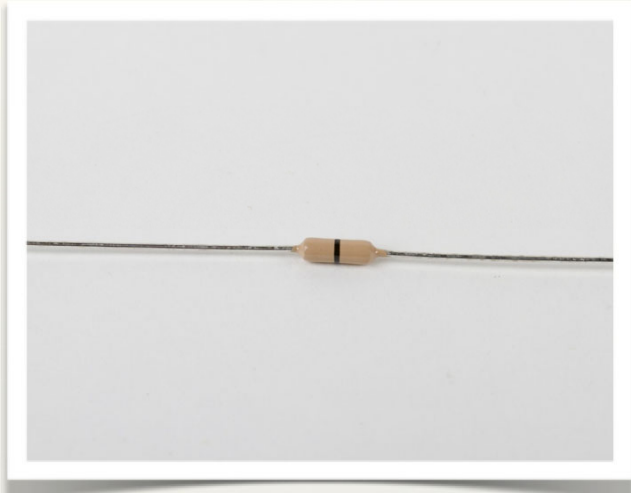
The four locations highlighted are power jumpers JP1-JP4. These jumpers control whether the Octolively's power supply is or is not connected to the edge connectors.



JP1 and JP2, by edge connector J1, (if installed) connect +5 V and GND to the module above this one. JP3 and JP4, (if installed) connect +5V and GND to the module to the left this one.

In the next step, we'll install these power jumpers.

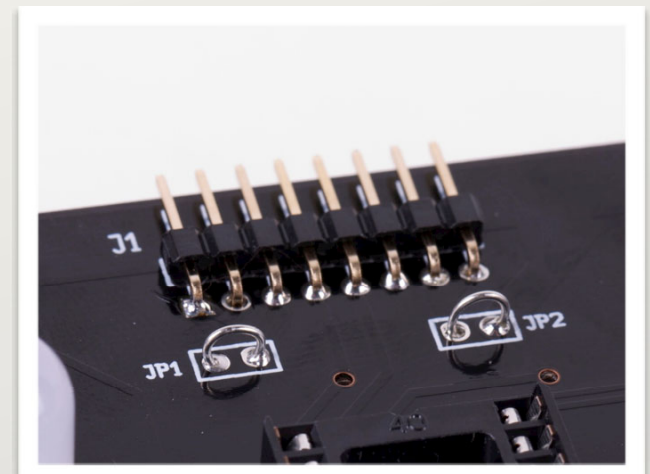
Assembly Step 22 – Edge connectors, part III: Installing power jumpers



Four wire jumpers, **#18**, are included with the kit. These look like resistors with a single black stripe.



To enable the edge connectors for power distribution, you can solder these jumpers into JP1-JP4.



For a slightly more elegant appearance, *just use the wire from the jumpers*, to form little wire loops that you can solder in place.

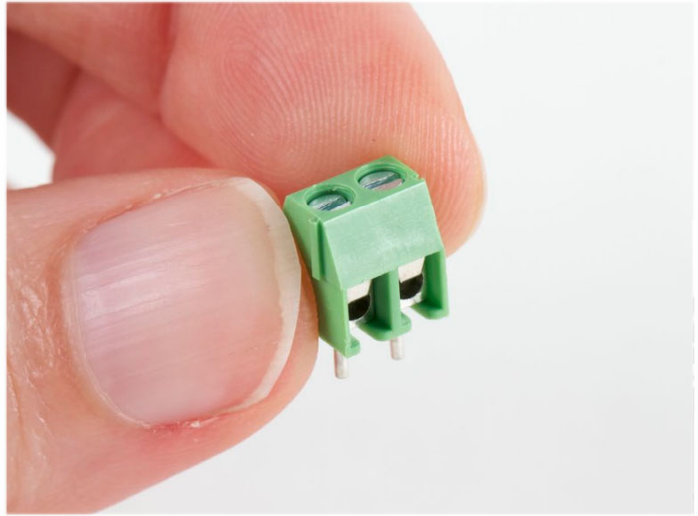
(Once the edge connectors are enabled with the power jumpers, you can disable them by clipping the little loops, or re-enable them by soldering them back together.)

Assembly Step 23 – The Microcontroller

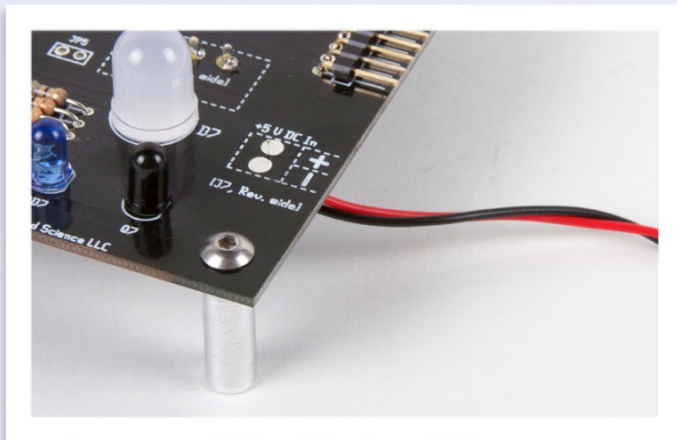
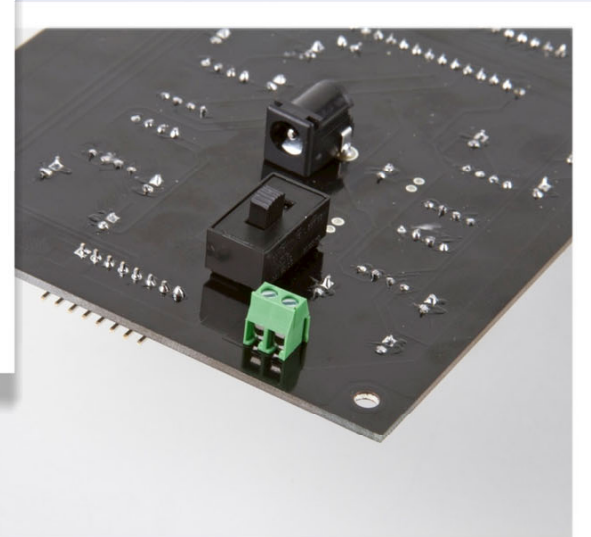
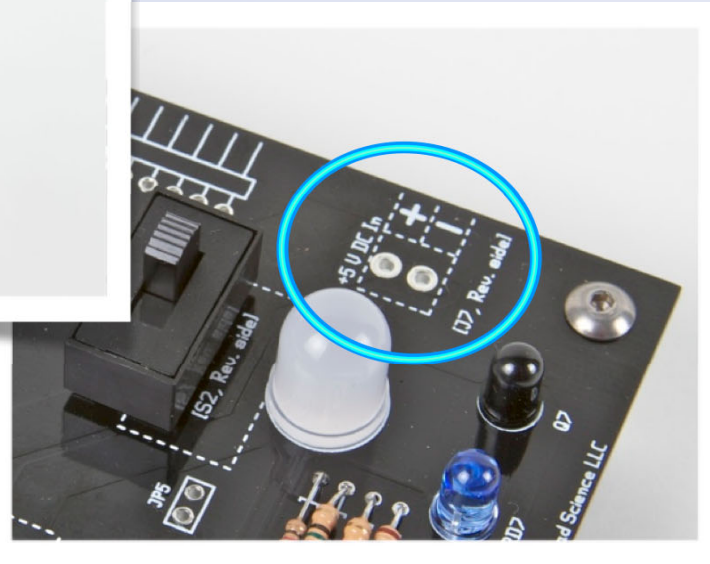
Part **#19** is the ATmega164P Microcontroller.

- Match the notched end with the notch on the socket and circuit board.
- Insert the chip firmly and fully into the socket, pressing from the top and bottom of the board to secure it into place.

Assembly Step 24 – Optional screw terminals / hardwiring point



Location J7 on the bottom side of the circuit board is for an optional 2-position screw terminal for connecting 5V power (+ 5V DC/GND) to Octolively.

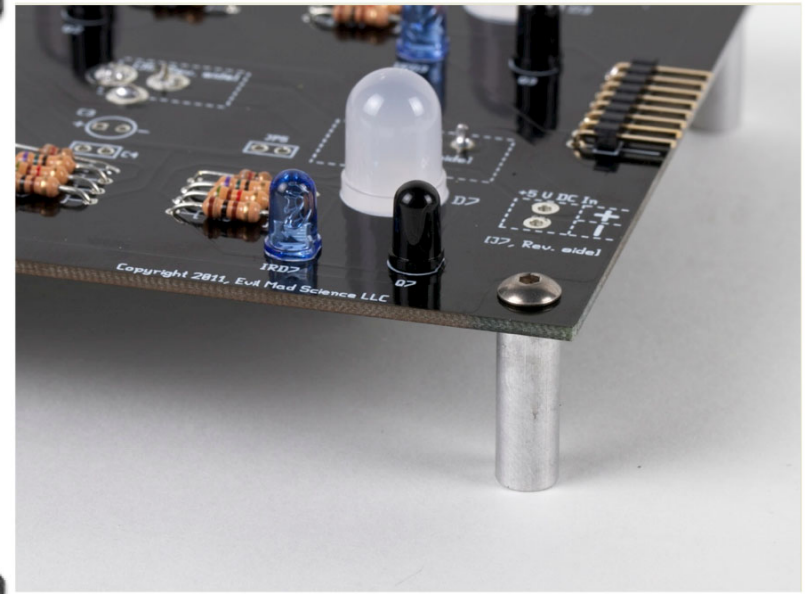


If not installing the screw terminal, J7 can be used as a port for hardwiring your power connections (+5V DC /GND) to Octolively.

Assembly Step 25 – Mounting hardware

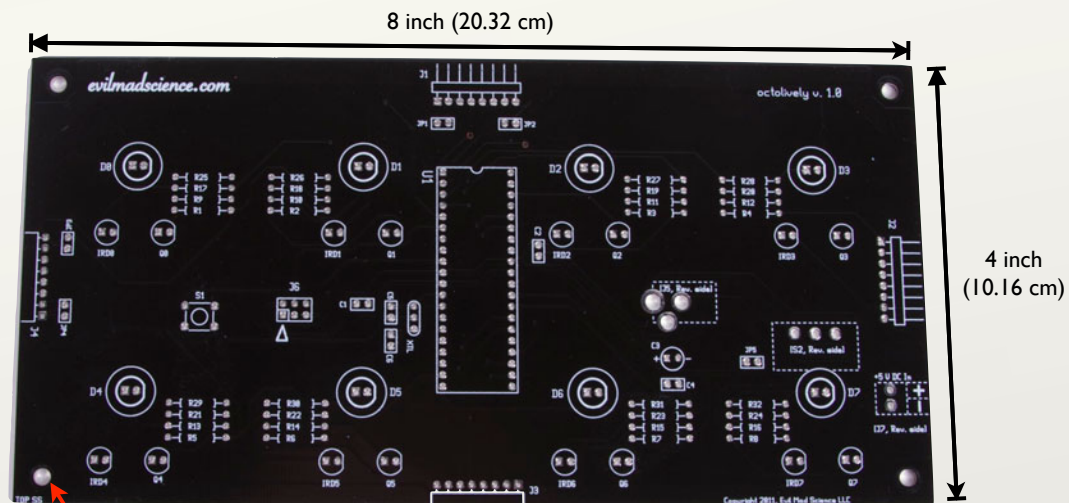


Parts **#20** are the 6-32 x 3/4" aluminum standoffs (4 pieces).
Parts **#21** are the 6-32 by 1/4" button socket cap head screws.

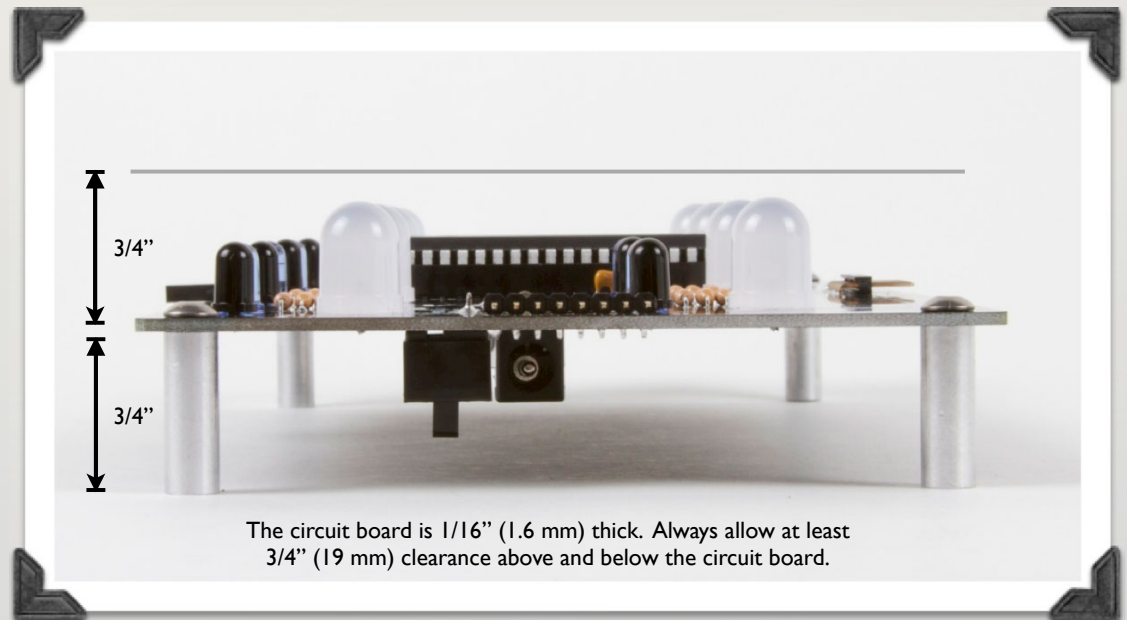


Mount the standoffs at each corner of Octolively.
You can tighten the screws with a 5/64" (2 mm) hex wrench.
If you do not have one, drop the screw through one of the holes, put your finger over the screw to hold it still, and thread the standoff fully onto it. (If you press firmly on the screw head while doing so, you can get the standoff very tight this way.)

Octolively: Mounting dimensions



Mounting holes: 6-32 clearance (4),
located 1/4" X 1/4" from each corner



The circuit board is 1/16" (1.6 mm) thick. Always allow at least 3/4" (19 mm) clearance above and below the circuit board.

Octolively: Options and Settings

There are 8 standard response functions.

To advance to the next response function, press the button once. When you do so, the “next” LED in sequence will light up for about two seconds (to indicate which program), and then the board will go begin working with the new response function.

0. Gentle fade
1. Slow fade
2. Quick fade
3. Ripple
4. Sparkle
5. “Heating” with fade
6. Shadow mode
7. Trigger and very slow fade

(Program 0 is indicated by LED D0, and so on.)

Try them all out, and see which you like best!



Octolively has a single control button.

There are four built-in levels of sensitivity.

To change the sensitivity level, hold the button for about ten seconds until it enters a different mode, where 1, 2, 3, or 4 pairs of LEDs are lit. While in this “sensitivity adjustment” mode, press the button to switch between the four sensitivity levels.

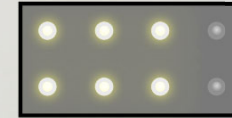
Higher sensitivity increases the effective sensing range, but can also lead to more jittery behavior and “false positive” motion detection.



Lowest sensitivity



Low sensitivity



High sensitivity



Highest sensitivity

Octolively

Interactive LED Kits



evilmadscience.com

For design files, source code, & additional documentation,
please visit:

<http://wiki.evilmadscience.com/Octolively>

Need help?

Use our support forum: <http://www.evilmadscientist.com/forum/>

or contact us by e-mail: contact@evilmadscience.com