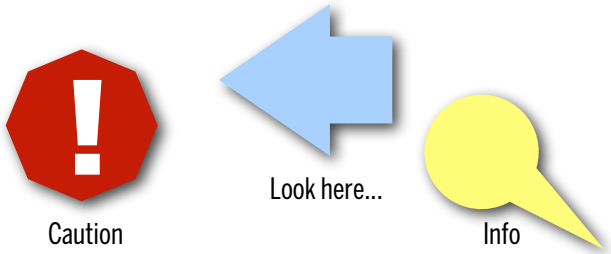
TELEGRAPH DECODER KIT

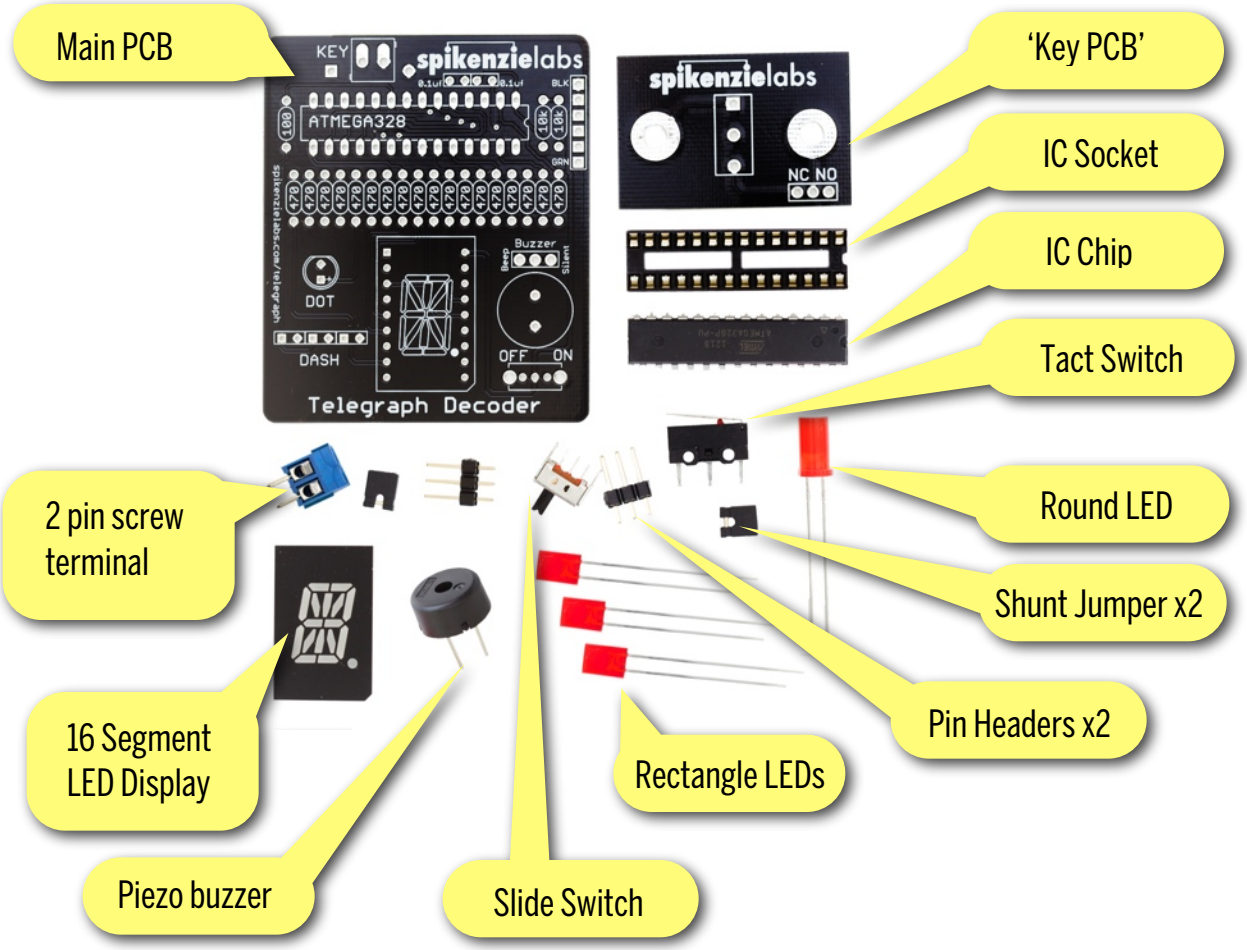
Complete build guide

spikenzielabs.com

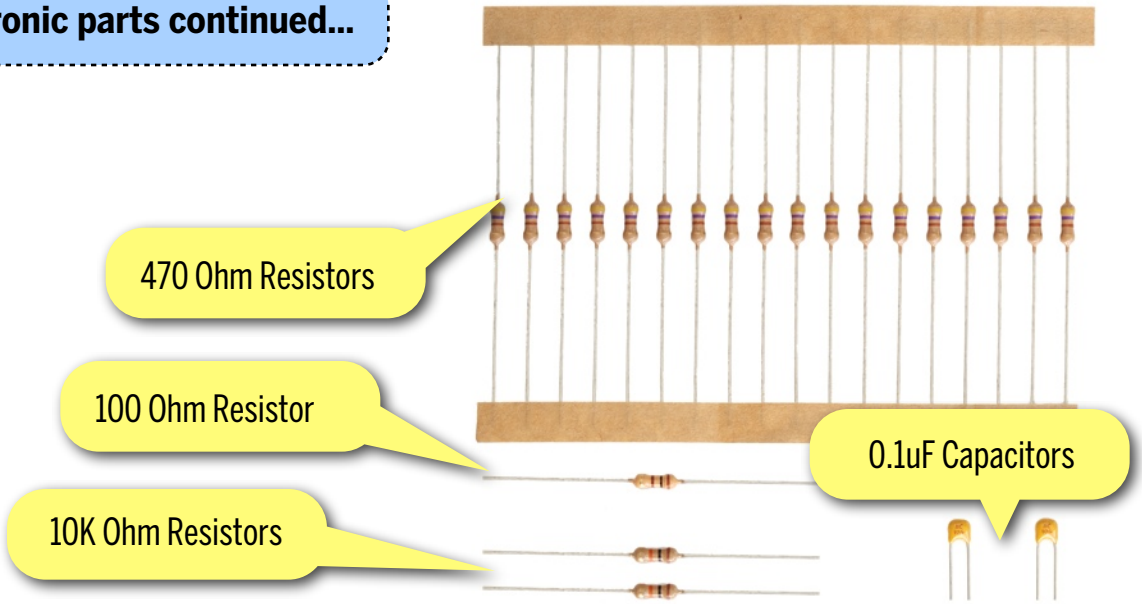
In this guide, you will see a few different symbols, these are to call attention to certain elements of the build that require additional care & attention.



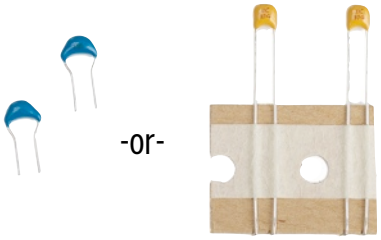
Step One : Unpack the electronics parts kit.



Electronic parts continued...

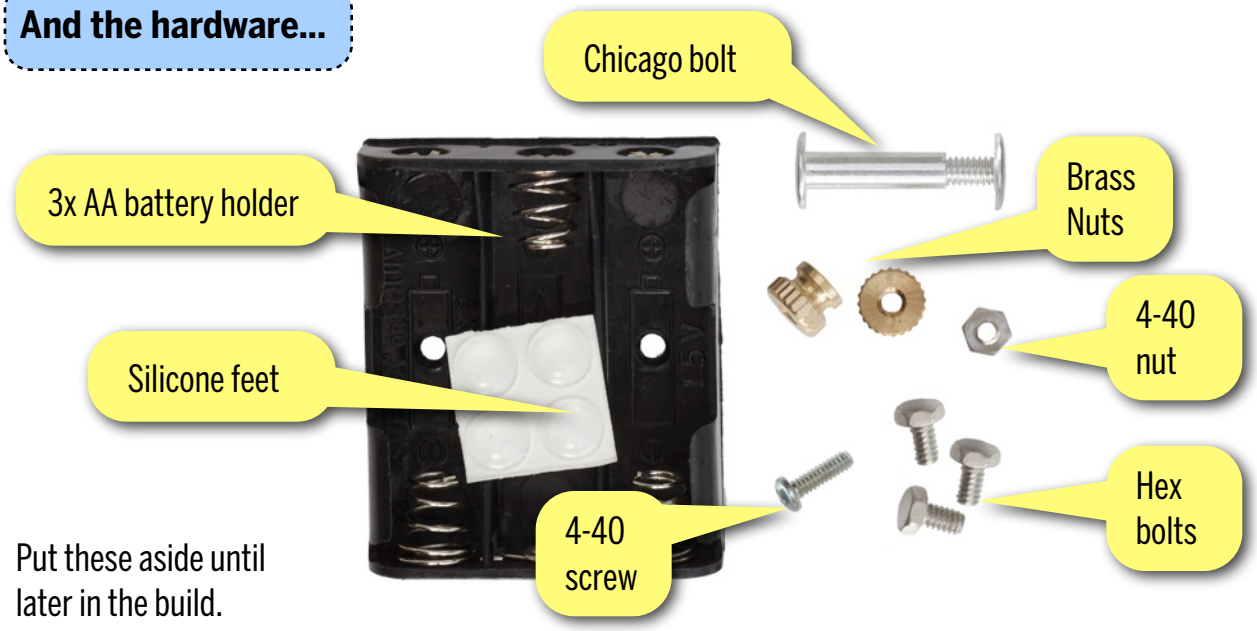


Quick note about the 0.1uF capacitors...
If in your kit, you see a pair of little blue 0.1uF capacitors, in place of the yellow ones, don't worry. They are functionally identical. Occasionally one is easier to get than the other.



Carefully pull the resistors from the tape, and clip the yellow capacitors from the card. To make installation easier, keep the 10k & 100 ohm resistors separated from the 470 ohm resistors.

And the hardware...

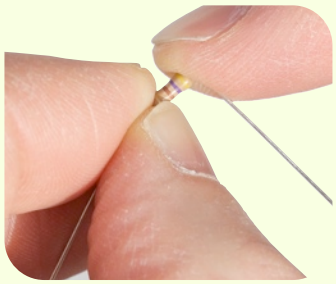


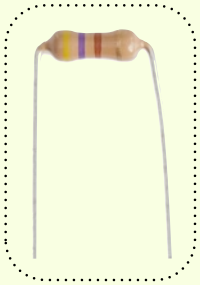
Put these aside until later in the build.

Step Two : Preparing the resistors for installation.

Resistor Bending:

Bend each of the resistors like in the photos to the right.
You want to have the bend of the leg as close as possible to the body of the resistor.



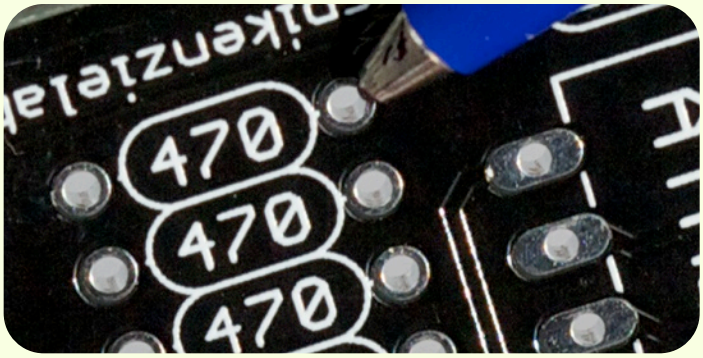


Do the same of all of the resistors... Keep in mind it is a good idea to keep each value resistor separate from the others. Mixing them up, and mounting a resistor in the wrong place, will likely cause your Telegraph Decoder to not work properly.

Step Three : Soldering the resistors

We will start by soldering all of the 470 ohm resistors. (There are a few of them to solder, so get comfortable...)

The 470 ohm resistors have the following color bands on them.



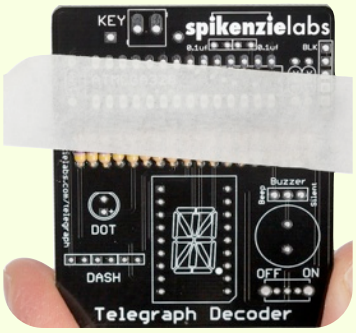
The orientation of the resistors doesn't matter. When we solder kits, we mount the resistors all in the same orientation. It makes for a prettier kit to look at, but makes no difference in terms of how the kit functions.

Insert all of the 470 ohm resistors as in the photo.

At this point, you should check to make sure that you only have 470 ohm resistors in the row.

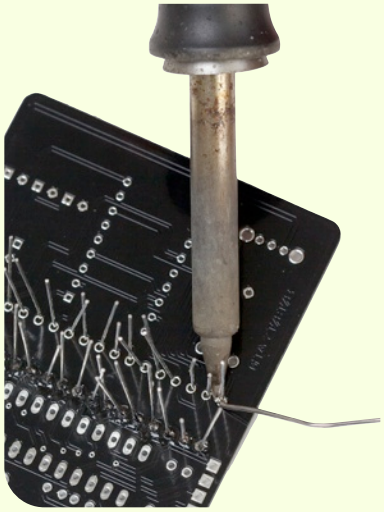
If you like, you can use a strip of masking tape to hold the resistors in place while soldering.

Flip the board over, and solder the resistors in place



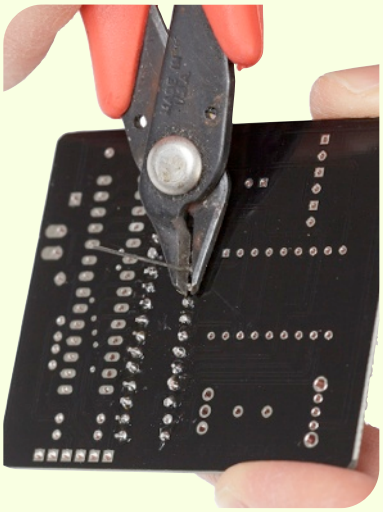
Snipping legs of components is about to start. If you haven't put on a pair of **safety glasses** yet, now is the time. When snipped, the bits get airborne, and somewhat unpredictable. **Working with someone? They need a pair too!**

Carefully solder each leg of each resistor.

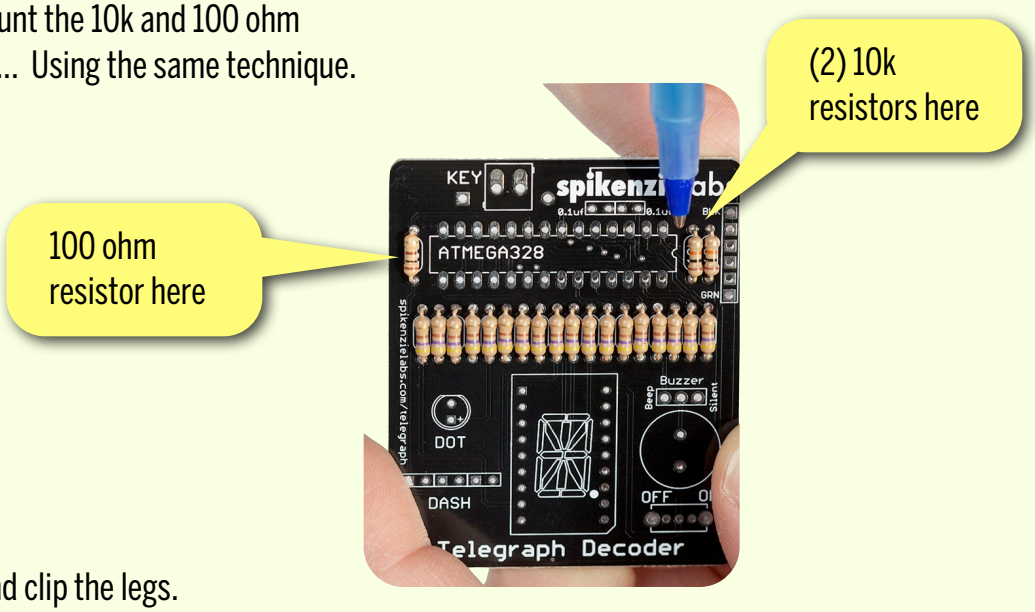


Don't pry or pull up on the leg with the snips. **It is better to snip twice than to scratch the PCB.**

Snip the legs close to the surface of the PCB without scratching it.

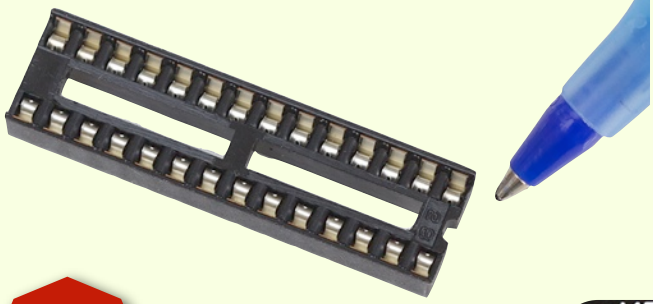


Next, mount the 10k and 100 ohm resistors... Using the same technique.



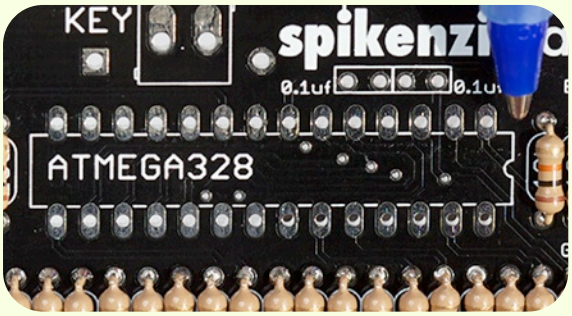
Solder and clip the legs.

Step Four : Install the IC socket



Match the notch on the socket....

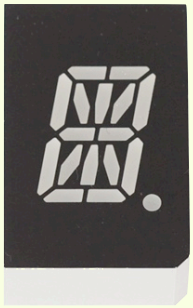
.....with the notch marking on the PCB



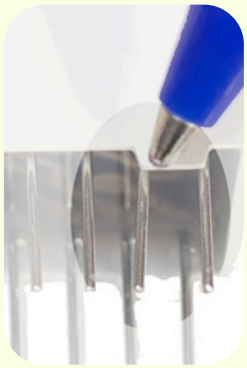
If you happen to solder it wrong by accident, be sure to keep in mind the notch on the chip needs to match the notch printed on the PCB.

Solder all 28 legs in place.

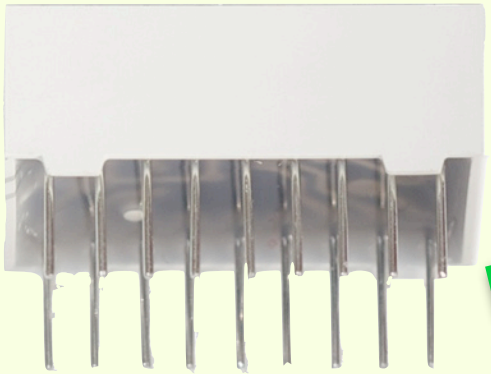
Step Five : Mounting the 16 segment LED display



First:
Carefully remove the 16 segment display LED from the pin protecting pad



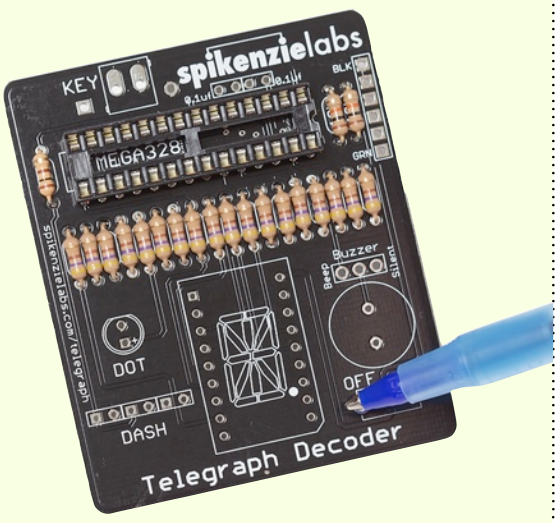
Second:
Inspect each leg, and make sure they are all straight. If they are not, you will have trouble mounting the LED module on the PCB.



Third:
When each leg is as straight as you can get them, (they should be pretty okay to start) proceed to the next step.

Mounting the LED module on the PCB

Guess what?
Another notch to look out for! Can't promise it will be the last one, but please do keep this in mind.
Match this notch with the notch printed on the PCB as in the photo (bottom right)

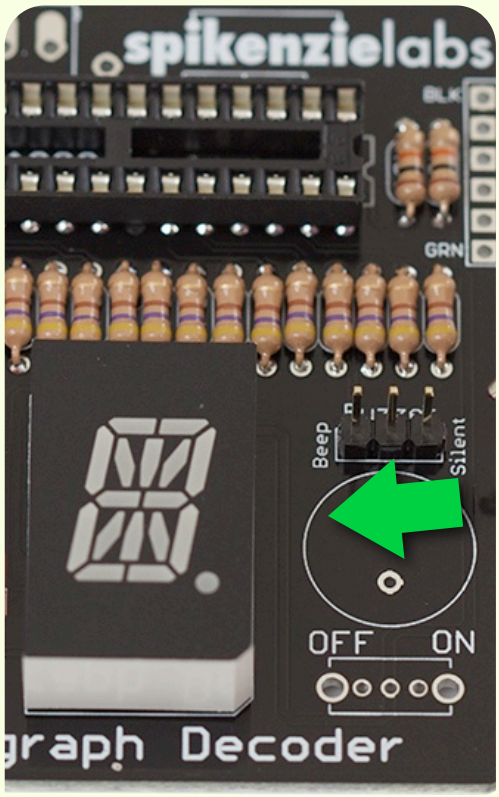


Carefully & gently slide the pins through the holes. Double check that the notch on the LED module and the printed notch on the PCB lines up, and solder the LED module in place.

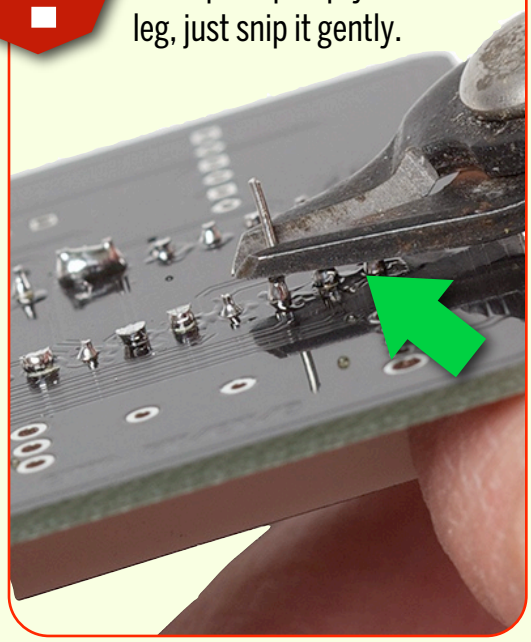
Start by soldering pins at **opposing corners**, for example the upper right and lower left. Double check that the bottom of the LED module is laying **perfectly flat**. Only if needed, reheat the pins while pressing gently on the face of the LED module.

Continue to solder the rest of the legs.

You should have your PCB starting to look like the photo to the right:



Don't pull up or pry on the leg, just snip it gently.

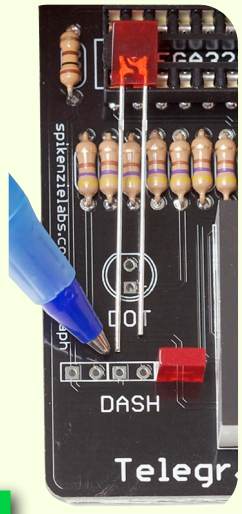


Be careful when you're snipping to not gouge the surface of the PCB. You can easily cut a connection on the PCB with your snips.

Catch anything wrong with this photo?
We will cover it near the end of this build.

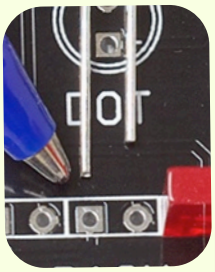
Step Six : Soldering the 3 'Dash' LEDs

ALERT:
Polarity Warning



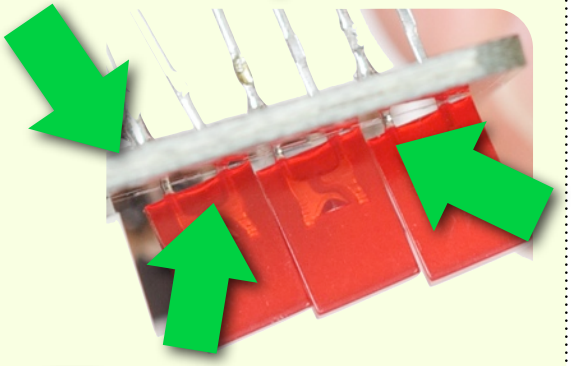
LEDs need to be installed in a particular orientation, or they will simply not work. Notice how one of the LED's legs is longer than the other?

The **longer leg** goes into the **square hole**.



Unless otherwise documented, the longer leg of a LED is **ALWAYS POSITIVE**.

Insert the 3 LEDs, and solder only the square hole for each LED. Turn the board over and check to make sure they are perfectly aligned.



If they look something like this photo, you can re-heat the soldered legs, while adjusting the position from the topside. Don't do this for too long, or too many times, as you can damage the LED.

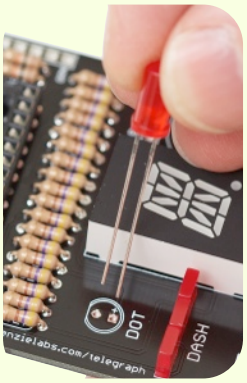
When the LEDs look like this:

You're all set, solder the round hole legs of each LED, trim the legs carefully, and proceed to the next step.

Step Seven : Soldering the round DOT LED

Now, slide the longer leg of the round LED through the square hole. This one is marked with a (+) sign.

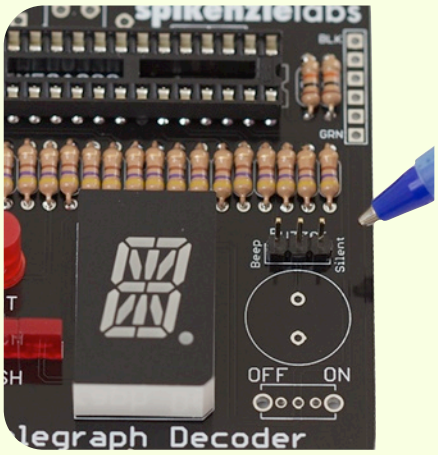
Trim the excess, and proceed to the next step.



Step Eight : Soldering the buzzer jumper

Place one of the 3 pin male jumpers as shown in this photo. The shorter leg side of the jumper goes through the holes of the PCB.

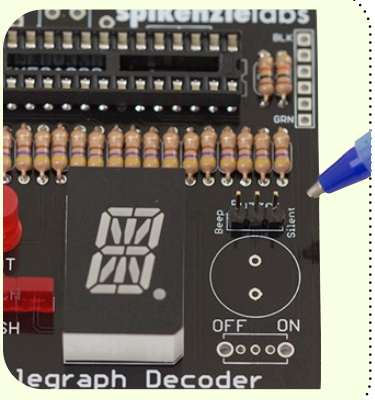
You can secure it with with a little bit of tape if you like. Solder one of the pins, check to make sure it is perpendicular to the surface of the PCB, and then solder the other 2 legs. Take one of the shunt jumpers, and place it on two of the pins.



Step Nine : Soldering the piezo buzzer

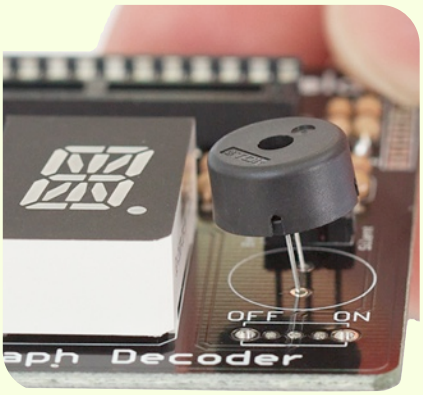
The piezo buzzer is installed directly below the jumper you just solder on, in the circle shown in this photo.

The piezo can be inserted in any orientation you like. This piezo is not polarity sensitive.



Slide the piezo's legs through the holes, hold it in place with a piece of tape if you like.

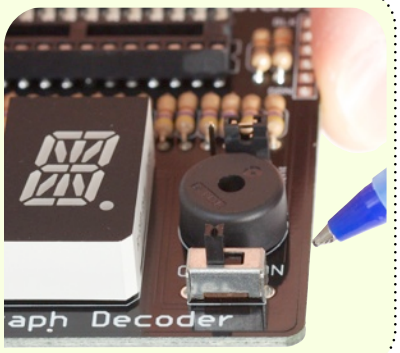
Solder and trim the excess legs on the bottom of the PCB.



Step Ten : Soldering the power switch

Now, the power switch. No polarity to worry about here.

Place the power switch on the PCB, and follow the same steps that you have for the other soldering components. Tape, solder, and trim the legs. You are all set.



Step Eleven : Soldering the two capacitors

These capacitors can be installed in either direction. In future projects, please keep in mind that certain capacitors do have a polarity to them. You can't go wrong with these ones.

Insert them through the PCB as indicated in the photo, you can hold them in place with a piece of tape. Solder and verify, and then trim the remaining legs.

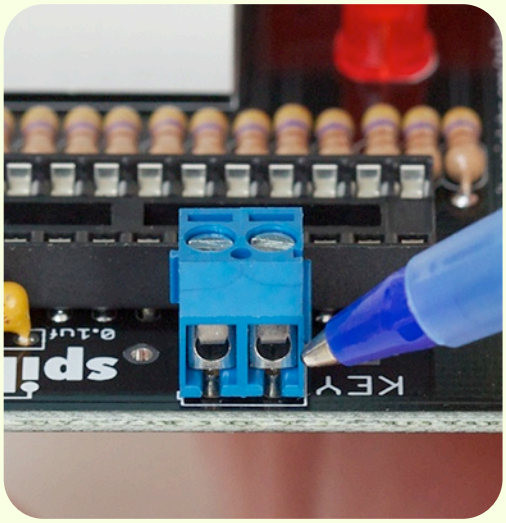
Your kit may have blue capacitors instead of yellow ones. They are the same value.

Step Twelve : The screw terminal

Place the screw terminal on the PCB, in this orientation. Make sure that the open entry points are aimed towards the top of the PCB. This will allow you to insert the wires leading to the 'telegraph key'.

Hold in place with a bit of tape, and solder it in place.

Trim these legs as flush as possible without damaging the surface of the PCB. The legs are fat on this component, and when snipped, they will likely fly across the room. **Keep those safety glasses on!**



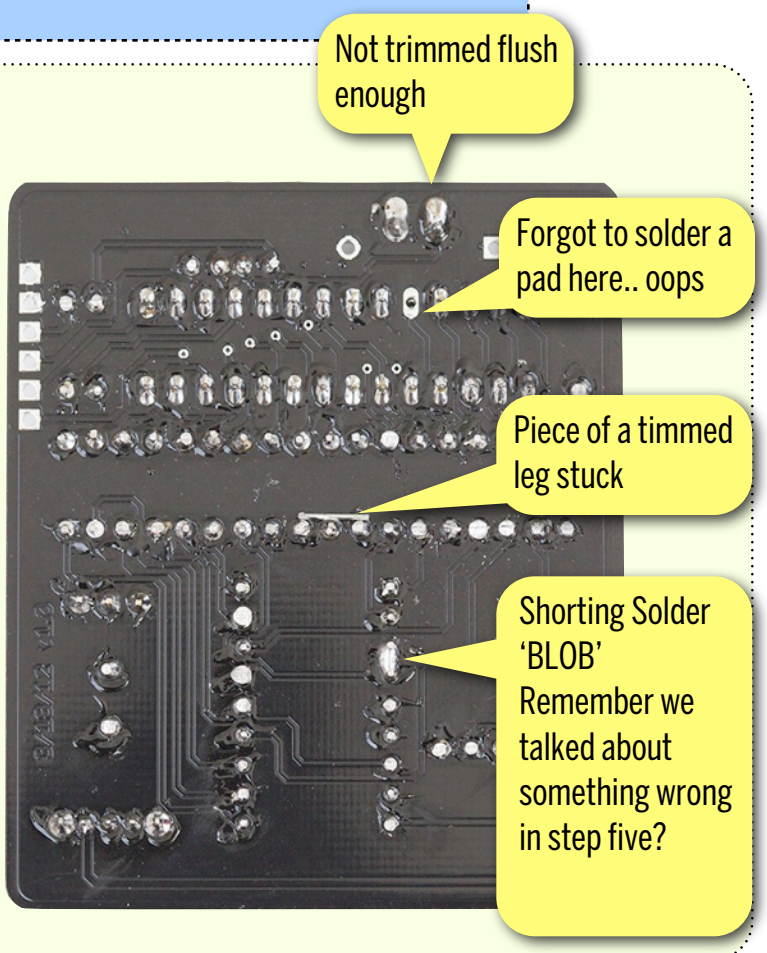
Step Thirteen : Inspection

Time to review the bottom 'soldering' side of the board.

Take a close look, and see if you can find mistakes.

We included some in our soldering to help show you what they may look like.

Once the battery pack is installed, you won't be able to correct mistakes without desoldering the battery pack. It's not impossible to do, but it can be pretty tricky.

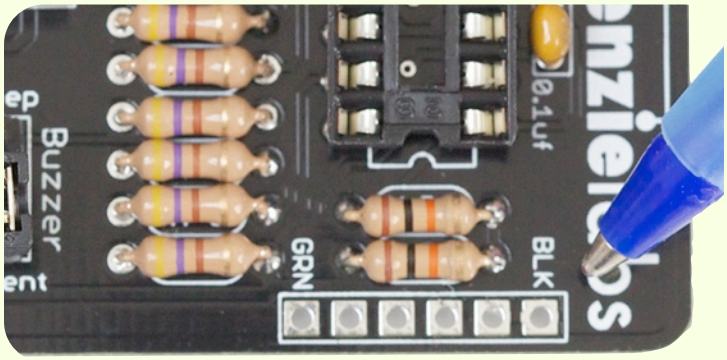


Optional Step : Hacking / playing with the program?

The ATmega328p that comes in your kit is pre-programmed with the Telegraph Decoder program.

If you are planning on hacking the program, (available online) you will need to do one additional step.

Solder 6 male pin headers here:

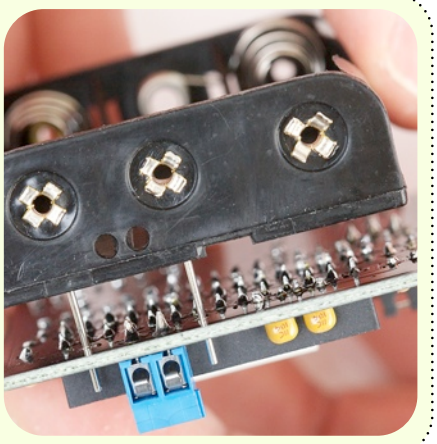


Step Fourteen : Soldering on the battery pack

The battery pack gets installed in this way:

Notice any obstructions stopping the battery pack from laying as flush as possible to the soldering side of the PCB? In this photo, we intentionally left the legs of the screw terminal too long.

Carefully trim them close, and try again. (if this is the case)



Ideal battery pack installation:

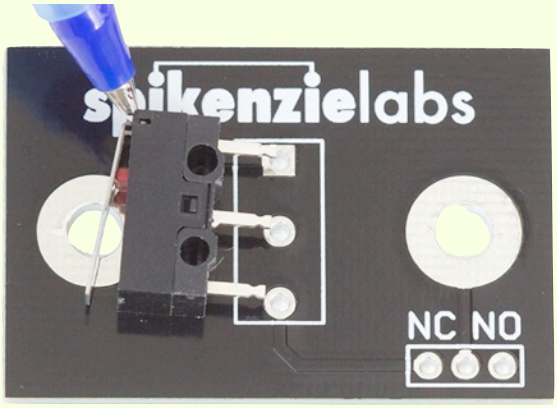
This is the first time soldering on the top side of the PCB. When soldering, make sure not to accidentally burn any components.

Solder on the component side of the PCB, and carefully trim the excess legs. **These will also likely go airborne, so keep those safety glasses on, and proceed with great caution.**

Step Fifteen : The key switch PCB

Place the tact switch with the hinged side of the switch towards the SpikenzieLabs logo, and push the legs through the holes.

Hold the switch in place with a piece of tape. Solder, and trim the excess.



Now take the remaining 3 pin male header, and mount it through the three holes in the PCB marked 'NC NO'. Solder it in place.

Place the remaining shunt jumper across 2 of the pins as indicated:

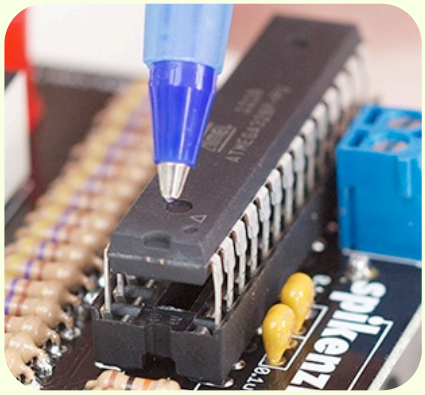
Step Sixteen : IC Chip mounting onto the socket

From the factory, most chips have their legs 'flared out' just a bit. To properly install this chip in the provided socket, a slight bend is necessary.

Hold the ends of the chip using both hands, and press against a hard flat surface. Do this carefully and slowly.

When the legs are look like the photo beside the green tick mark, you're all set.

When you think you've got it, orient the notch on the top of the chip to match the notch on the socket, which should match the notch on the PCB.



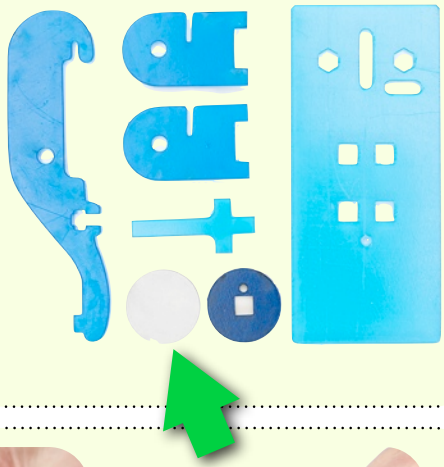
If by accident, you've installed the chip socket in the opposite orientation, match the notch on the chip to the notch on the the PCB.

When the pins are perfectly lining up as in the photo, press down with equal pressure until it won't descend any more.

Now the soldering portion of this build is complete. Turn off your soldering iron, and wash your hands.

Key Build

Included in your kit, there are varying thicknesses of laser cut acrylic. They all have protective film which is applied to the surface to protect the surface during transport and laser cutting.



One of the pieces has double sided highly adhesive tape. It is the round black piece **without** holes in it. Remove the film from one side, leave the slippery tape peel away piece on until later in the build.

On all of the other pieces, start peeling off the protective film. You can use your fingernail to get it started, and then continue to peel both sides of each piece, excluding the slippery double sided tape on one side of one of the pieces.

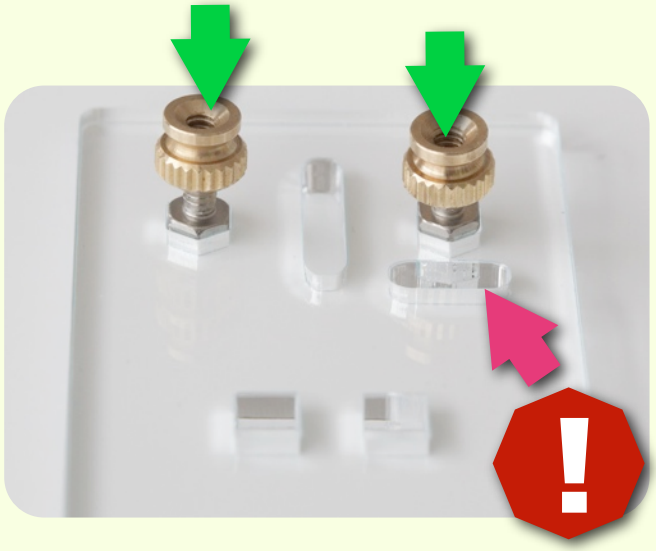
Don't use a knife or other hard / sharp object. You can scratch the acrylic.

It will make the build easier if you handle the black laser cut acrylic by the edges only. Oils from your fingers will make the double sided sticky tape a little less sticky.

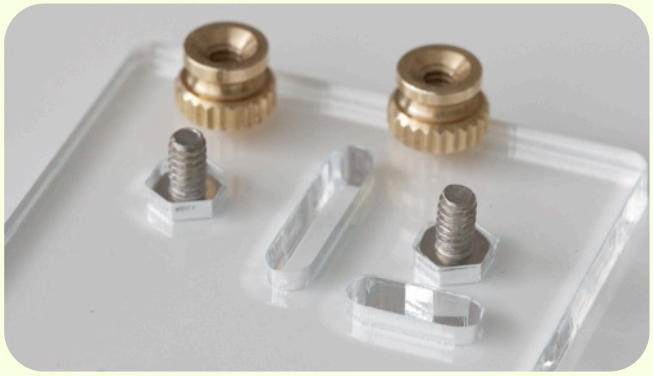
Take 2 of the hex bolts, and screw the knurled brass nut upside-down on them. (Flared side down) as in this photo:

Make sure the opening for the jumper selector on the key base is on the right.

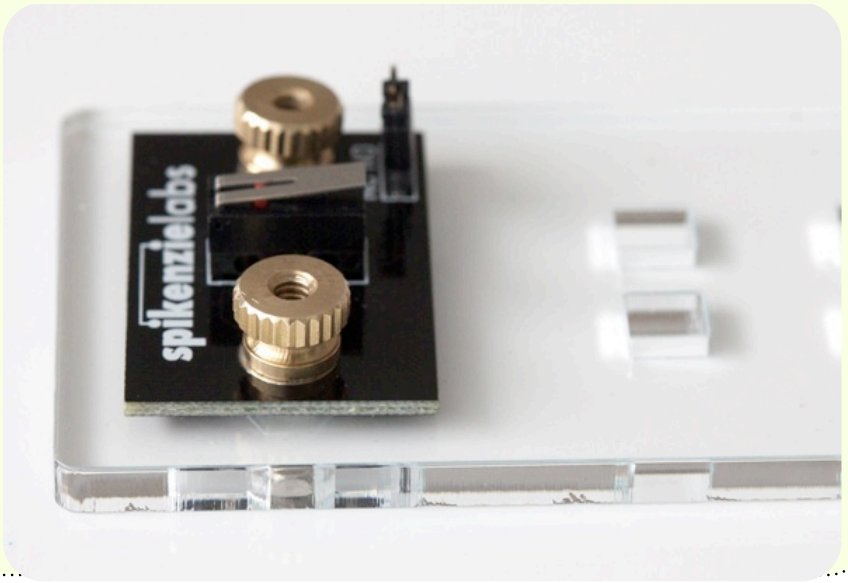
Use a small hammer to lightly tap the head of the bolt under the surface of the plastic base.



If the bolt head ends up a little deeper than the surface, that's alright. Unscrew the knurled brass nuts, and set aside.



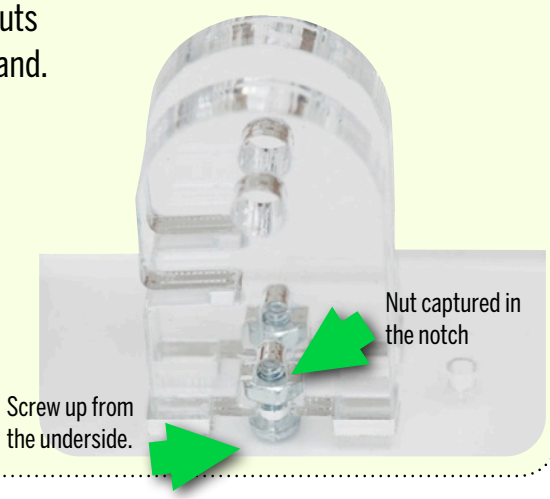
Place the key PCB over the bolts, and secure in place with the knurled brass nuts in their proper orientation (Flared side up) Don't over tighten.



With the PCB screwed on, finger tighen the last remaining hex bolt on the **SAME SIDE** of the plastic. Screw it in only about 1/16" of an inch. You will adjust it in a later step

Your kit may have shipped with a set of nuts and screws, as well as a notched pivot stand.

If so, attach the pivot stands in the following way, **instead of the way shown below.**

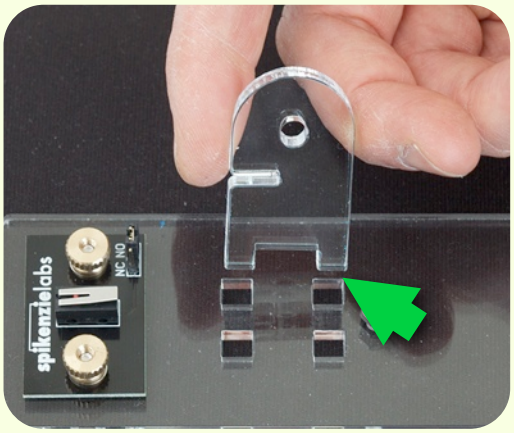


The pivot stand

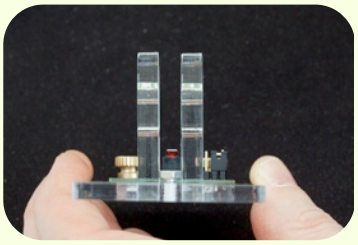
Install 2 of these pieces onto the top of the base.

Gently ease them in place, they will friction fit, and stay in place.

Aim to have them parallel to each other, with a uniform gap between them all the way from the surface up.



Don't hammer, just press straight down. Stop when the middle of the pivot stands hits the base piece, and the tabs are fully inside the holes. Do one at a time.

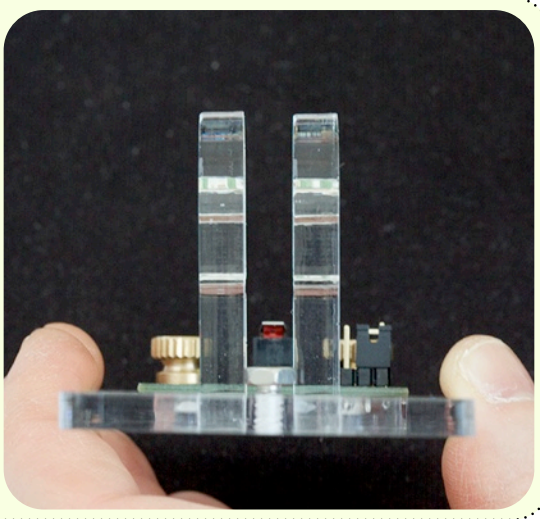


Test the alignment.

Compare your construction to the photo to the right:

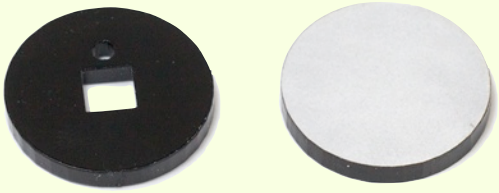
Slide the Chicago bolt through one side until it comes out the other. The bolt should move smoothly, (not loosely) and should not bind.

Adjust as necessary. If the stand is not aligned, the key will not move freely.



The key top:

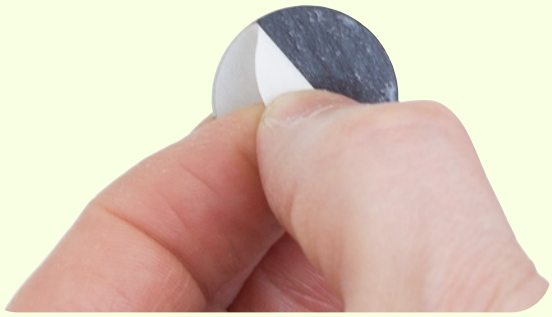
Clean the surface of the black disc that has a hole in it. If you haven't handled it too much after peeling the plastics off, it should be free of oils / dust.



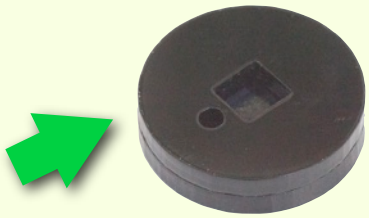
Practice lining up the two discs before removing the slippery film covering the double sided tape.

We find that holding them by the edge, and pressing against a flat surface works best.

Remove the slippery film, exposing the sticky tape, and press them together. For this step, it is important to get the two black discs stacked perfectly one on top of the other. Once they have stuck together, it is not very easy to separate them to redo this procedure.

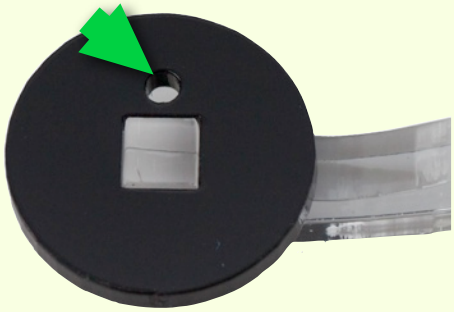


Once you have them stuck together, your result shout look a lot like this:



Lever Arm:

Mount the black button to the end of the lever arm like in this photo:

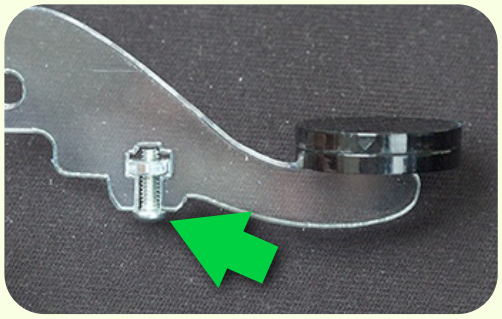


The little circle cut out of the bottom of the black button goes towards the left or right of the lever arm. This is a 'press fit' press the button onto the end of the lever arm with equal force beneath, and from the top. It will slide into position, and then stop.

If the key top is loose, you can apply a little crazy glue inside the hole, or hot glue with the button in place underneath to secure it.

Attach the 4-40 screw and nut into the space provided on the bottom of the lever. See this photo for the easiest way to install.

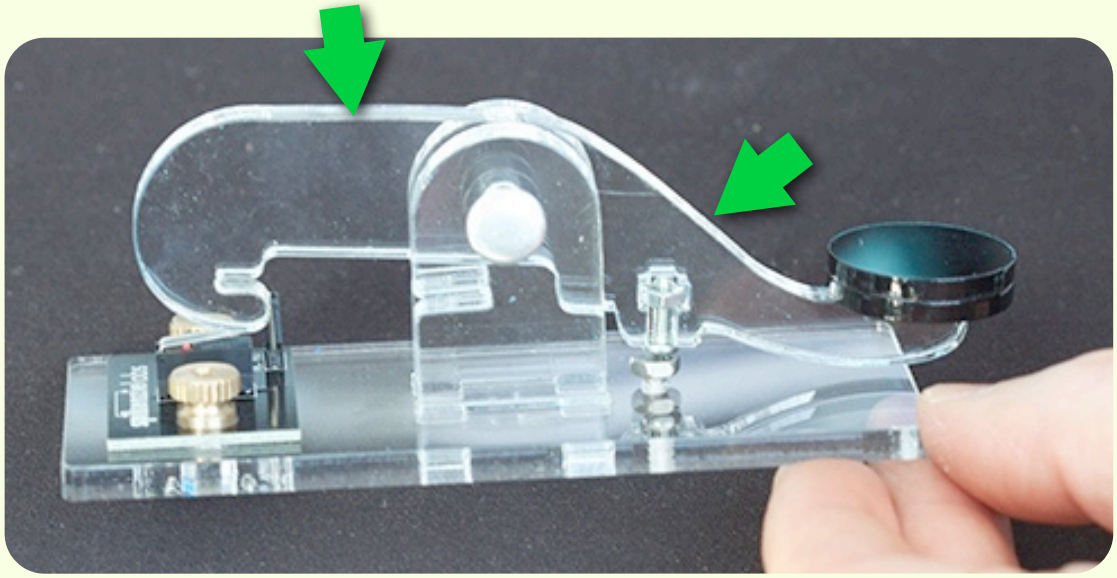
Put the 4-40 nut onto the end of the screw, then slide it from the side it into position on the lever.



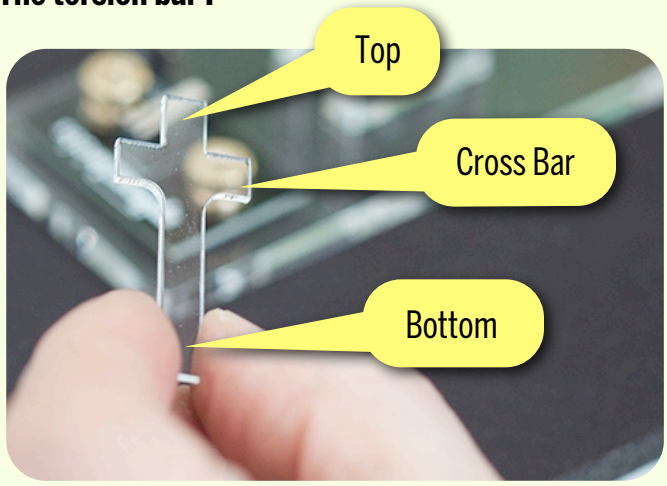
Don't over-tighten the screw. If you hear the acrylic starting to crackle and squeak, you're overdoing it.
BigTime! :)

Place the lever arm between the stands. Do this with the black button top aiming away from the PCB on the plastic. Line up the hole in the Lever Arm, with the holes that the Chicago bolt goes through. Does the key 'see-saw' freely? Great. If not, you need to adjust the pivot stands. Slide the Chicago bolt out, remove the lever arm, adjust if necessary and re-test.

Once you are satisfied that the arm pivots freely, remove the Chicago bolt, and the arm.



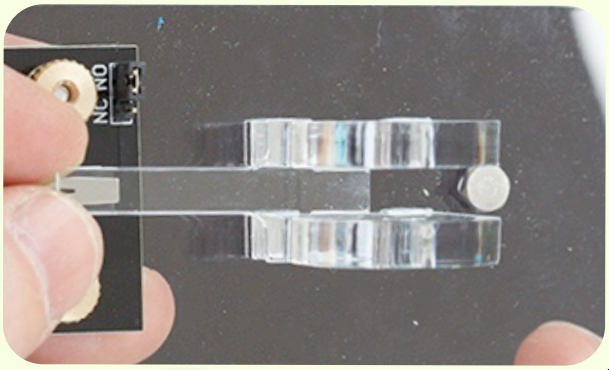
The torsion bar :



The torsion bar is what brings the telegraph decoder key to life.

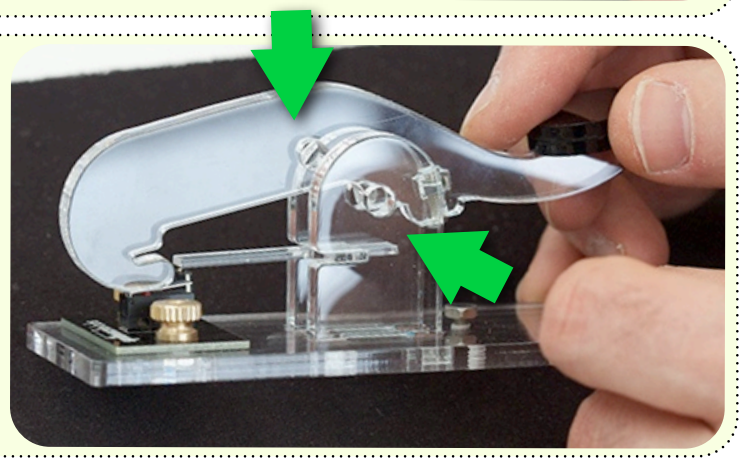
See the bubbles to the left to become more familiar with the way we are describing the parts of the spring. This will help with the installation step.

Holding the torsion bar at the bottom, slide the top of the torsion bar between the arms of the pivot stand. The cross bar will glide between the guides on either side.



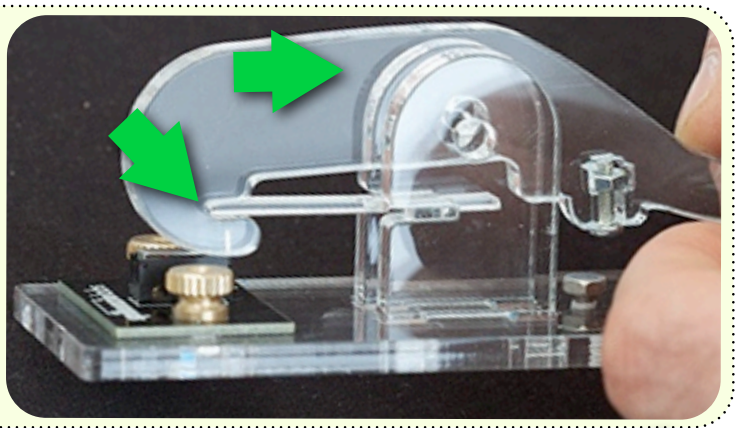
Take the key arm in your other hand and slide it further towards the back of the stand than it would be when the Chicago bolt is in place. See the photo here:

Note the hole in the arm is set back from the holes in the pivot stand.



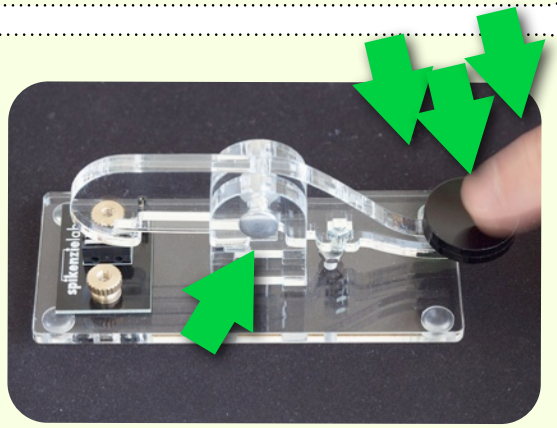
Now catch the bottom of the torsion bar with the 'hook' at the bottom rear of the lever.

Slowly slide forward, and line up the hole in the lever, with the holes at the top of the pivot stand.



With the holes lining up, slide the Chicago bolt all the way through, and screw on the cap. Do not over tighten.

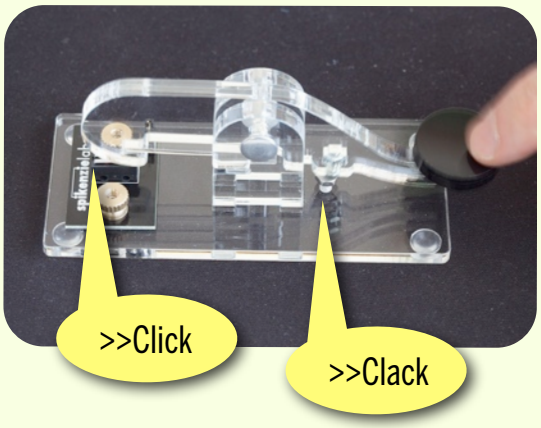
Check for a nice springy return, and adjust if necessary.



Adjusting the stopper bolt:

Press the key a few times. Listen carefully for the switch to click, followed by the sound of the phillips head screw bottoming out on the stopper bolt.

You will want to raise or lower the stopper bolt so that the switch clicks, and then the screw and bolt heads touch right after. If the the stopper bolt is too high, and the switch won't click.



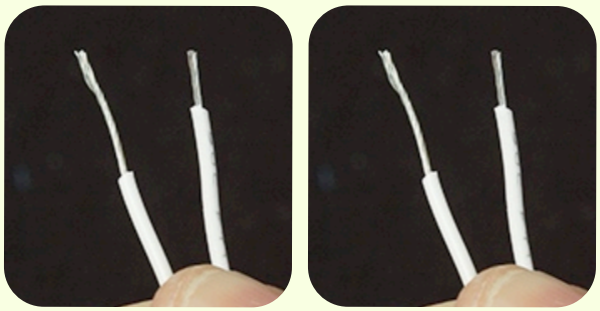
Still not clicking?

You may need to put a gentle bend on the end of the metal arm so that it makes contact with the end of the lever. Put a gentle bend, and try again. Don't stress the switch hinge.

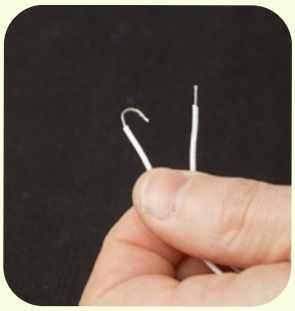
The key is now ready to be connected to the Telegraph Decoder

Wiring it up

Take two equal lengths of stranded wire. On each wire, strip 1/4" of the shielding off one end. On the other end, strip off about 1/2". You will have 2 wires that look like this:
(If your kit came with one long wire, cut it in half)

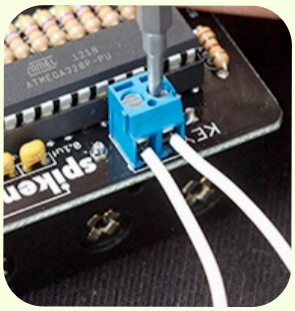


Take the two 1/2" ends, and bend them into a 'C' shape as in the photo:



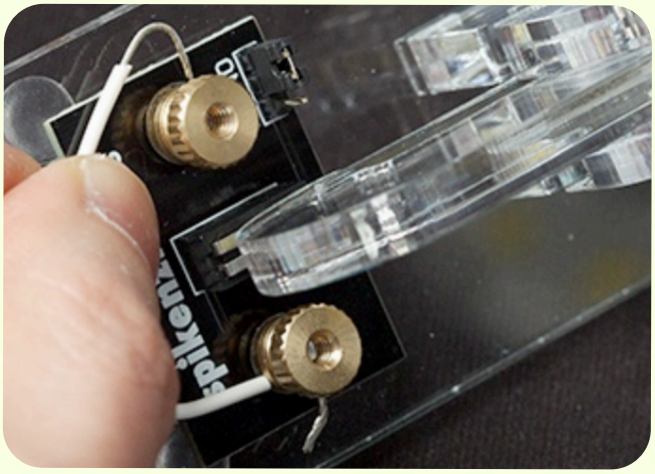
Take the two 1/4" ends, and insert them into the blue screw terminal at the top of the Telegraph Decoder PCB.

Either terminal will do.



Loosen the brass nut just enough to easily slide the 1/2" bare wire underneath, and secure it down. Finger tight only.

Repeat for the other side. It doesn't matter which wire goes to which side, so long as each wire goes from the key to the Telegraph Decoder PCB, you will be okay.



Let's try it out

Set the power switch to the off position.

Load 3 fresh AA batteries into the battery holder underneath the PCB

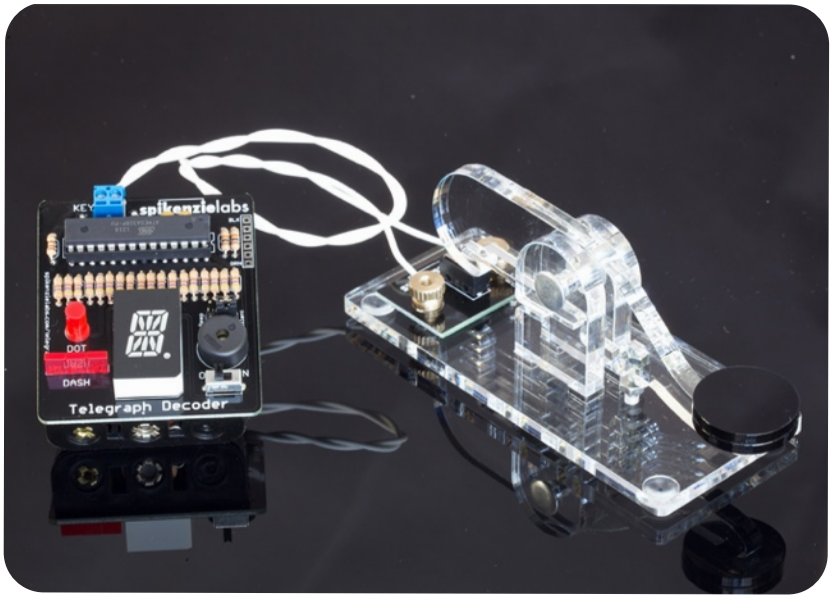
Without pressing the key, turn the power switch to the on position.

Does the decimal point light up on the LED module?

If it does, switch the jumper setting on the keyer PCB from NC to NO, or vice-versa.

CONGRATULATIONS!

Your Telegraph Decoder is now ready to decode some messages!!



Telegraph Decoder Usage

Basic keying:

This mode decodes key presses and displays the result.

Steps:
1. Set the jumper to "Beep" or "Silent"
2. Turn power switch to "ON" - (Default Message displays)
3. Press the key fast for a "DOT" and longer for a "DASH"
4. After you have keyed in a letter (or waited too long) the decoder will try to decode the letter / number you keyed in. If the letter is recognized, it will be displayed on the LED display. If not "Er" for error is displayed indicating that the code keyed in was not recognized.
5. The last character decoded will remain on the display until:
(You key in another) or (turn off the decoder) or (after about 20 seconds the Decoder goes into a very low power sleep mode. To wake it simply start keying another letter.)

Keying with auto message playback:

This mode decodes a group of characters and then displays them in a repeating, one character at a time sequence.

Steps:
1. Set the jumper to "Beep" or "Silent"
2. HOLD DOWN THE KEY SWITCH while you turn power switch to "ON" -
    - If you got it right, the decimal point will give you a quick double flash.
3. Press the key fast for a "DOT" and longer for a "DASH"
4. After a character is decoded it is displayed on the LED.
5. Another character is keyed in. It is displayed on the LED. Repeat until the message is finished being keyed in.
5. If no other character is started for a about five seconds the repeat sequence starts. The start is signaled by a double flash of the decimal point.
6. The repeat sequence will continue on the display until: (You key in another) or (You turn off the decoder) or (after about 20 seconds the Decoder goes into a very low power sleep mode. To wake it simply start keying another letter.)
Once you start keying in a new character the old repeating message is erased and a new one is started. If you only key in one character the decoder does not go into auto playback mode.

Multiple Telegraph Decoder Usage : Hookup Descriptions

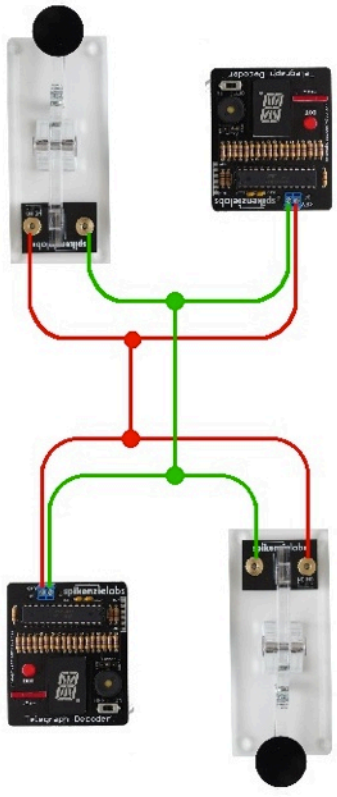
Dual Telegraph Decoder hook up:

There are two ways to use two (or more) Telegraph Decoder kits. One is to have the characters decoded on both decoders (Local echo). Like this you can see the message that you are sending as it is being sent. The other is a little more challenging, were only the receiving decoder will see the message (No echo).

Dual Telegraph Decoder with Local Echo:

1. With a length of wire going into the screw terminal closest to the "S" in SpikenzieLabs logo on the decoder, connect it to the other Decoders SAME screw terminal closest to the "S". Also connect this wire to one terminal on each of the key switches (either will do).

2. Next take another length of wire and connect the other two screw terminal on the decoders and the remaining two thumb screws on the key switches. (See illustration)

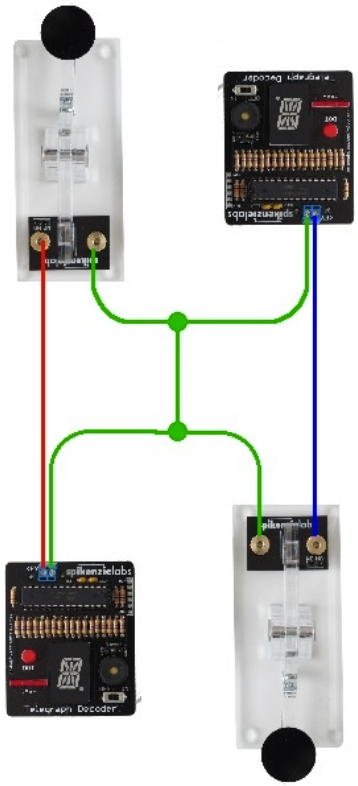


Dual Telegraph Decoder with No Echo:

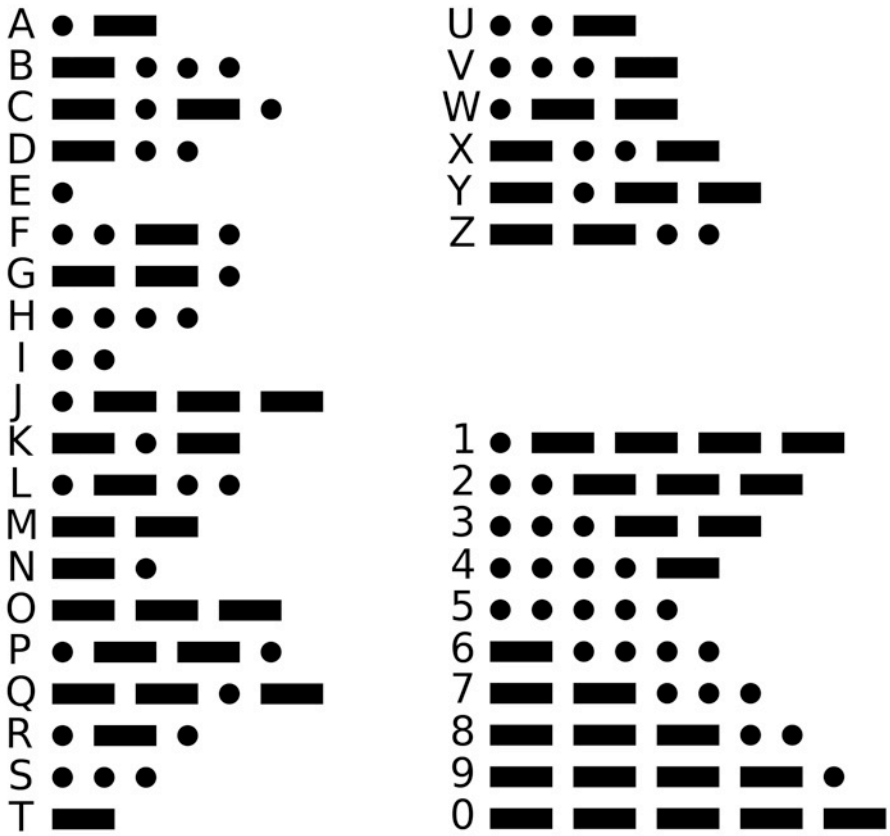
1. With a length of wire going into the screw terminal closest to the "S" in SpikenzieLabs logo on the decoder, connect it to the other Decoders SAME screw terminal closest to the "S". Also connect this wire to one terminal on each of the key switches (either will do).

2. Use a length of wire to connect the remaining screw terminal on one of the decoders with the remaining brass thumb screw on the OTHER key switch.

3. Repeat step 2 but use a third length of wire and connect the remaining screw terminal to the remaining thumb screw.



International Morse Code



Source: http://upload.wikimedia.org/wikipedia/commons/thumb/b/b5/International_Morse_Code.svg/2000px-International_Morse_Code.svg.png