

Alpha Clock Five

Alphanumeric LED Clock & Data Display Devices



– Assembly Guide –

An open-source hardware+software project. For support links,
design files, source code, & additional documentation,
please visit: <https://wiki.evilmadscientist.com/alpha>

For version 2.0 kits
– Red, White, and Blue Editions –
Manual v. 2.2
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Assembly Step I – Line numbers and the BOM

Your kit comes with a *bill of materials*, the authoritative, up-to-date list of what's included with your particular kit.

In the instructions, we refer to components by their line item number on the bill of materials. For example, #1 on the BOM is the Alpha Clock Five printed circuit board.

Alpha Clock Five

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.

>>> [<<](mailto:sales@evilmadscientist.com)



White Edition

To put your kit together, you'll need the build instructions.
Please visit: <http://wiki.evilmadscientist.com/alpha>

BILL OF MATERIALS: Alpha Clock Five, White Edition. Kit version 2.0 / Firmware version 2.0

Line	Ref Des	Description	Manf./Vendor	Part number	Qty
1	n/a	Alpha Clock PCB, Rev C.	Evil Mad Scientist	60-0032	1
2	R5, R9	Resistor, 1/4 W Axial, 100 ohm	Digi-Key	100QBK-ND	2
3	R3, R4	Resistor, 1/6 W Axial, 10K	Digi-Key	10KEBK-ND	2
4	R1	Resistor, 1/4 W Axial, 340 ohm 1%	Digi-Key	340XBK-ND	1
5	R2	Resistor, 1/4 W Axial, 681 ohm 1%	Digi-Key	681XBK-ND	1
6	RP1, RP2	Res. pack, 10K, NOTE POLARITY	Digi-Key	4606X-1-103LF-ND	2
7	RP5, RP6	Res. pack, 1k isolated	Digi-Key	CSC1.0KG-ND	2
8	U1	Socket, DIP, 0.6" wide, 40 pin	Digi-Key	3M5471-ND	1
9	U2	Socket, DIP, 0.3" wide, 24 pin	Digi-Key	3M5465-ND	1
10	U3	Socket, DIP, 0.3" wide, 16 pin	Digi-Key	3M5463-ND	1
11	U5	Socket, DIP, 0.3" wide, 14 pin	Digi-Key	3M5462-ND	1
12	J4	Header, 0.1", 6 pin, DIL (extra long)	Digi-Key	609-3370-ND	1
13	M1	Header, female, 4 pin	Digi-Key	S7037-ND	2
14	J1	Power jack, 2.1 mm x 5.5 mm	Digi-Key	CP-002AH-ND	1
15	C5, C6	Capacitor, ceramic, 18 pF	Digi-Key	BC1004CT-ND	2
16	C1-3, 7, 8, 10, 12	Capacitor, ceramic, 0.1 uF	Digi-Key	BC1148TR-ND	7
17	XTL	Crystal: 16 MHz, 20 ppm	Digi-Key	535-9041-ND	1
18	J2, J5	Header, 0.1", 6 pin, SIL, RA	Digi-Key	WM6106-ND	2
19	D2	LED, 3 mm, White Diffused	Bettlux	BL-L312-UWW	1
20	Q1-Q6	PNP transistor, type 2STX2220	Digi-Key	497-7067-ND	6
21	U4	TL750L05 voltage regulator	Digi-Key	298-8002-5-ND	1
22	C4,C9, C11	Capacitor, aluminum, 100 uF, 16 V	Digi-Key	493-1040-ND	3
23	S1-S5	Switch, tactile RA, tall button	Digi-Key	P108805-ND	5
24	L1	Buzzer, Magnetic	Digi-Key	102-1155-ND	1
25	U1	IC, microcontroller, ATmega644A, preprogrammed with firmware v2.0	Digi-Key	ATMEGA644A-PU-ND	1
26	U2	IC, LED Driver, type MB15026	Macroblok	MB15026GN	1
27	U3	IC, LED Driver, type MB15168	Macroblok	MB15168GN	1
28	U5	IC, Buffer, type SN7407N	Digi-Key	296-1436-5-ND	1
29	n/a	Bracket, right angle, 6-32 threaded	Digi-Key	4334-KND	2
30	n/a	6-32 x 3/8" Phillips Screw	McMaster-Carr	91772A146	4
31	LD1-LD5	Machine Pin Socket, 10 pin SIL	JameCo	102201	10
32	LD1-LD5	LED, Alphanumeric White 2.3" (each)	Bettlux	BL-S230B-13W-12	5
33	n/a	Power Supply 9 V 1 A (2.1 mm plug)	Various		1
34	n/a	Chronodot Module	Macetech		1

Case kit:	Line	Description	Manf./Vendor	Part number	Qty
	35	Acrylic Case, front (smoke)	Evil Mad Scientist	61-0039	1
	36	Acrylic Case, back (smoke)	Evil Mad Scientist	61-0036	1
	37	Acrylic Case, top (black)	Evil Mad Scientist	61-0037	1
	38	Acrylic Case, bottom (black)	Evil Mad Scientist	61-0038	1
	39	Hex nut, zinc plated, 4-40	McMaster-Carr	90480A005	12
	40	4-40 x 1/2" Phillips screw, black	McMaster-Carr	91249A111	12



This assembly guide covers both the Red, White, and Blue editions of Alpha Clock Five. These editions have slightly different circuitry, and thus different instructions in several of the assembly steps. In those steps, please pay careful attention to follow the instructions labeled for your color of clock.

(There are also "Basic Edition" Alpha Clock Five kits, which are normal Alpha Clock Five kits except that they do not include the Chronodot module or acrylic case.)



Acrylic Case



Chronodot Module

Assembly Step 2 – Tool Checklist

Four 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



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

4. Screwdriver

Phillips-head screwdriver, medium size. (#1 is ideal.)



Suggested, but not required



Resistor lead forming tool

Allows fast, neat bending of resistor leads. Not that many parts like this in the kit, but if you like it extra nice....

And for the adventurous...



I. USB-TTL Cable

FTDI model TTL-232R or equivalent. A "smart" converter cable with a USB interface chip inside. One end hooks up to your USB port, the other to the clock. This allows you to program the Clock through a modified version of the Arduino development environment (<http://arduino.cc/>).

Besides programming, the cable can also be used to sync the time or display data on the clock through a serial program.

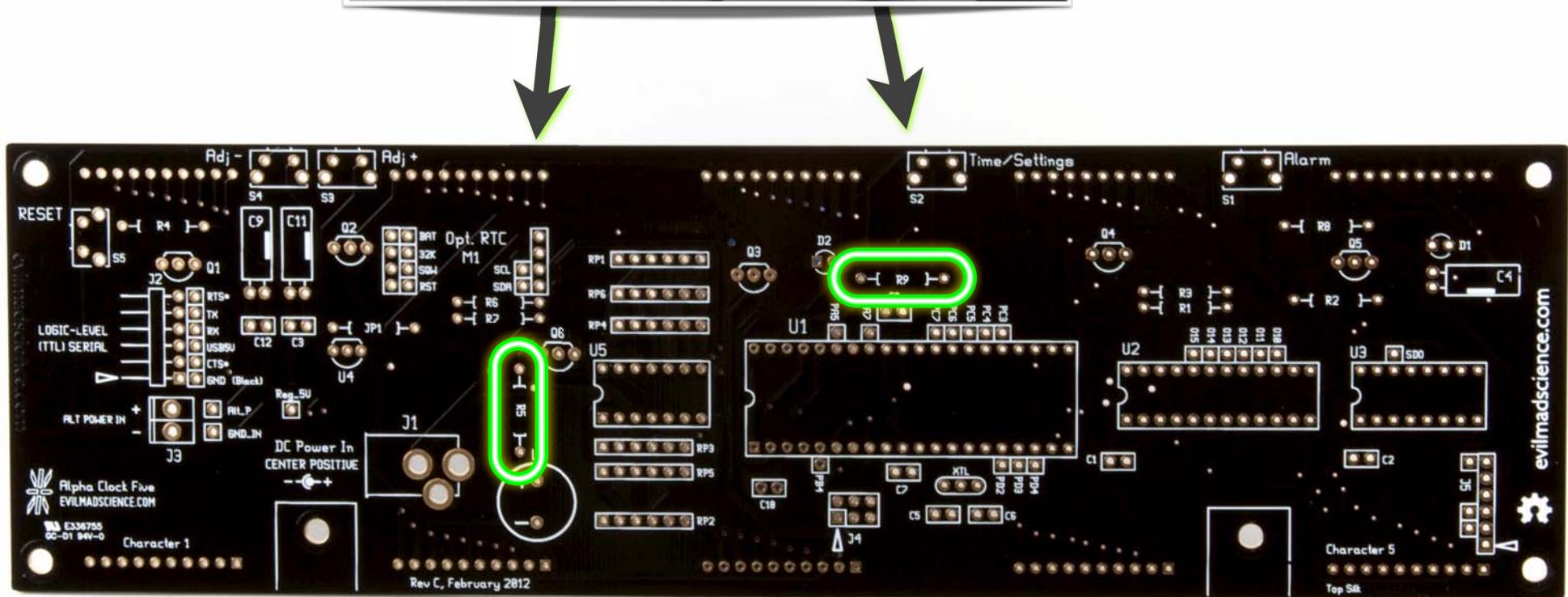
2. Computer, Internet access, USB port....

All of the software and source code that you'll need to reprogram Alpha Clock Five is available online for free. You'll need a reasonably recent vintage computer (Mac, Windows, or Linux) and internet access.

Additional information is available at the project page:
<http://wiki.evilmadscientist.com/alpha>

Assembly Step 3 – Circuit board and first component locations

Our first assembly step will be to add components in locations R5 and R9 on the circuit board. Locate these two locations on your circuit board, as shown highlighted here.



The Alpha Clock Five printed circuit board (PCB), listed as line item #1 on your bill of materials.

Sanity check!

This set of instructions is for Alpha Clock Five kits version 2.0, which are based around revisions C/D of the circuit board.

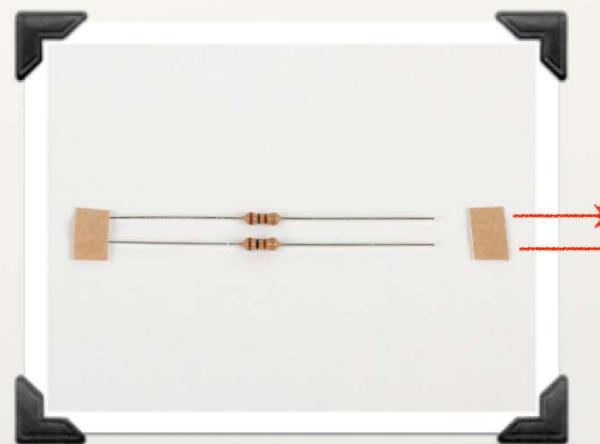
To make sure that you're reading the right set of instructions, confirm at this time that your circuit board says "Rev. C" or "Rev. D" at the location shown by this here arrow.

Assembly Step 4 – Place the first resistor

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



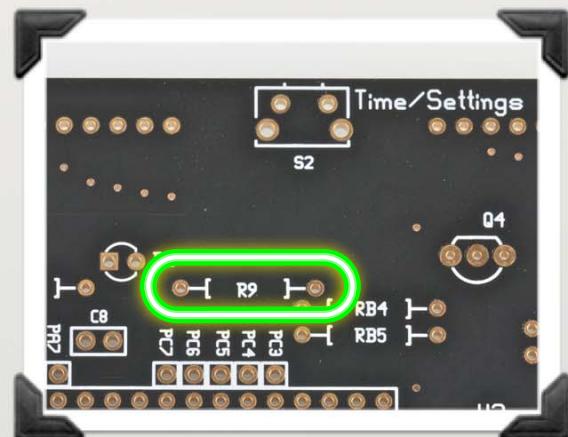
Parts #2. Our first components are 100 Ohm resistors. Identify them by their color code: Brown-Black-Brown-Gold



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



Take one of the resistors, and bend it like so.



Insert it at location R9
(the orientation does not matter)



And press it flush to the board



Next up: Soldering tips!

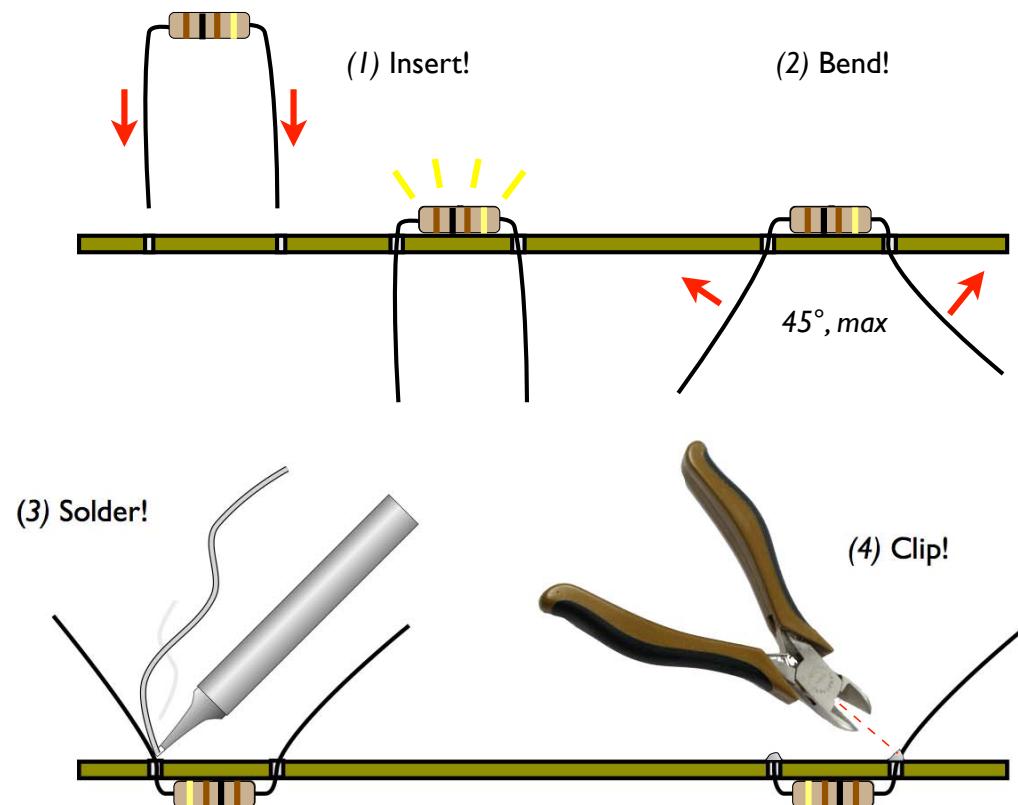
Assembly Step 5 – Some tips on soldering

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 the last step.)
- (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 chips 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 or flexible leads, clip off the extra length, close to the board. (But not so close that you’re clipping the board itself.)

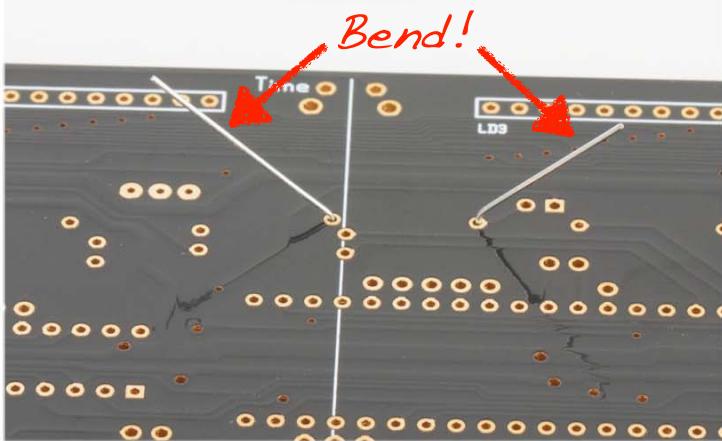


To be continued...

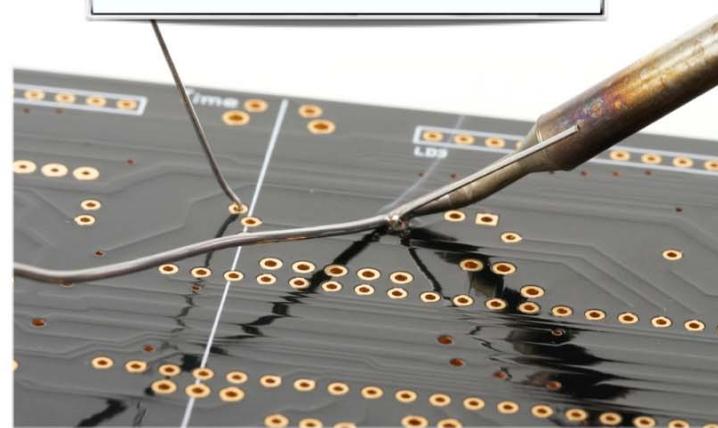
Assembly Step 6 – Solder that first resistor

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

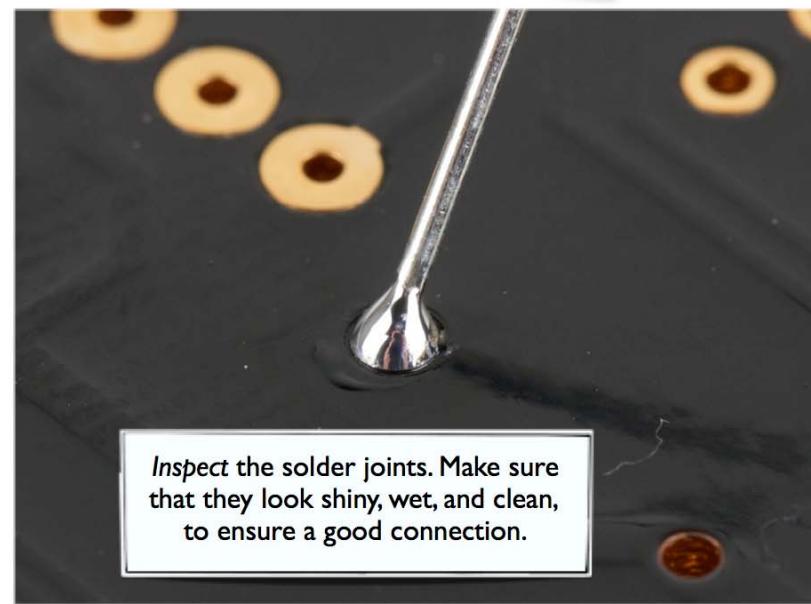
On the back side, Bend out the two leads of the resistor



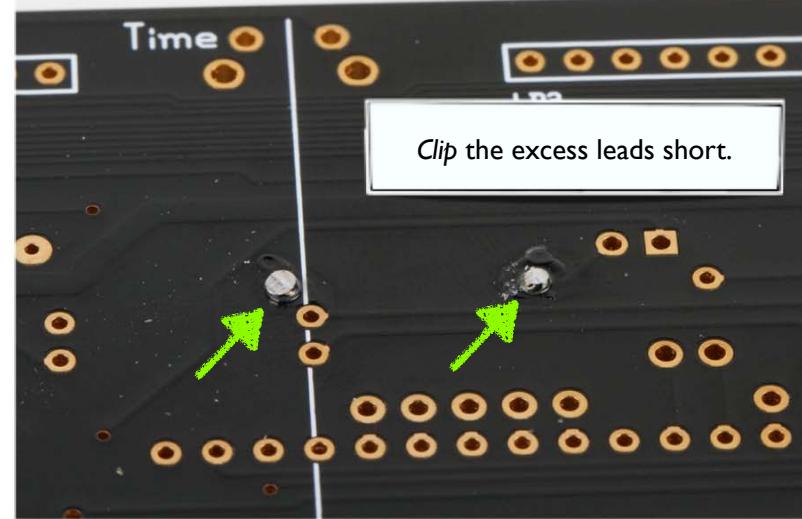
Solder both pins to the board.



Inspect the solder joints. Make sure that they look shiny, wet, and clean, to ensure a good connection.



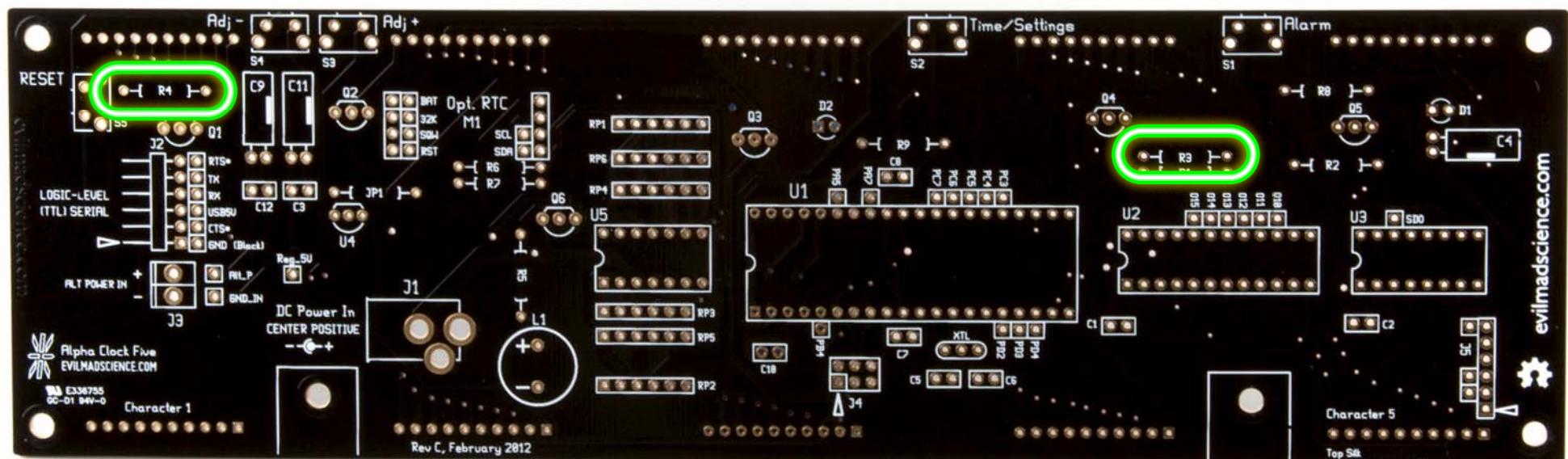
Clip the excess leads short.



And finally, repeat this procedure, to install the other #2 resistor at location R5.

Assembly Step 7 – Install Resistor #3

Next, solder parts #3, two 10 k resistors, into locations R3 and R4.



Parts identification:



#3 is the only smaller size resistor.



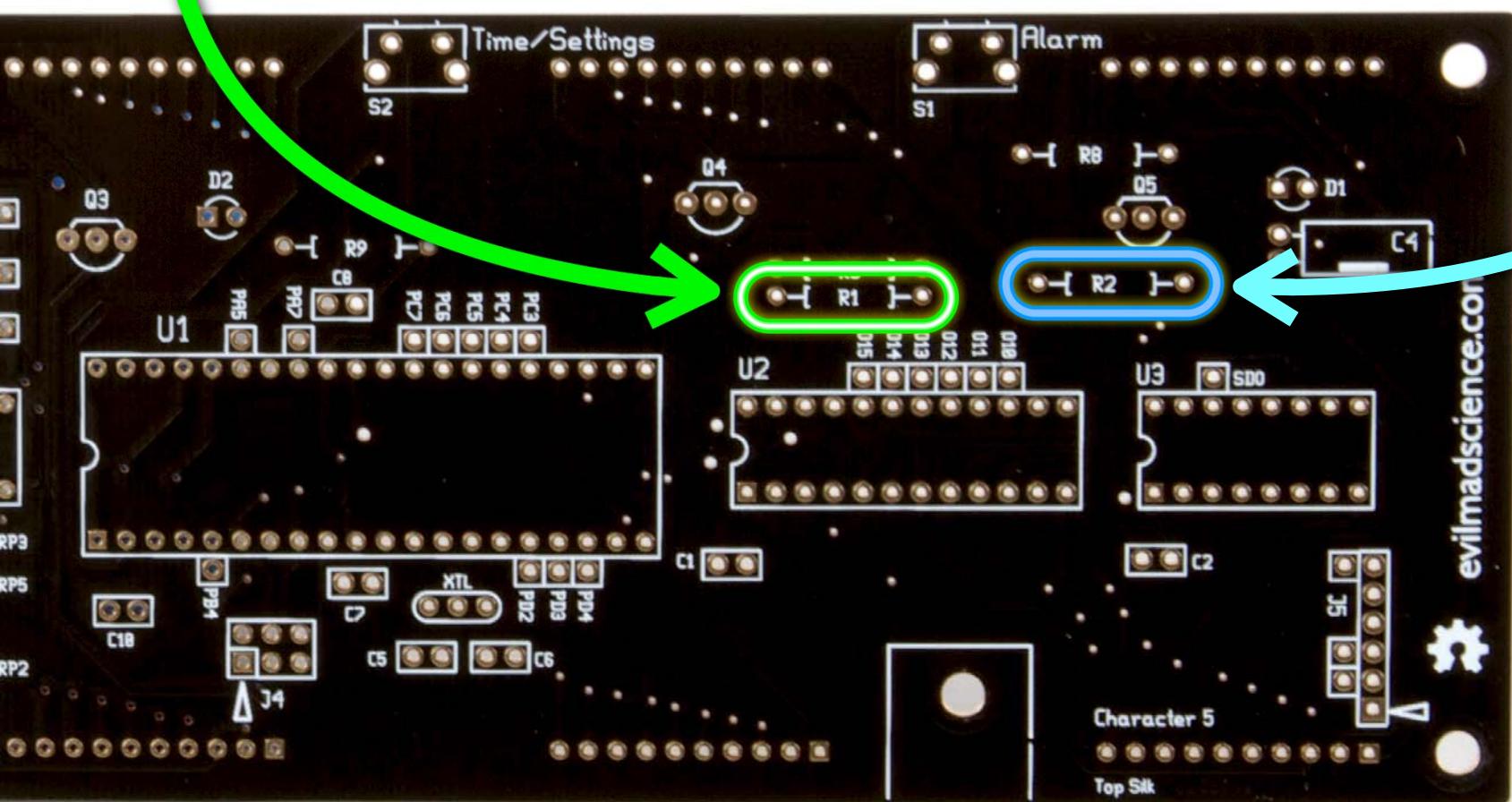
Up close, the color stripes are brown-black-orange-gold.

Assembly Step 8 – Install Resistors #4 & #5

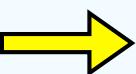
Part #4 is a 340 ohm “1%” resistor. There's just one of these. Solder it in at location R1.



Part #5 is a 681 ohm “1%” resistor. There's just one of these. Solder it in at location R2.



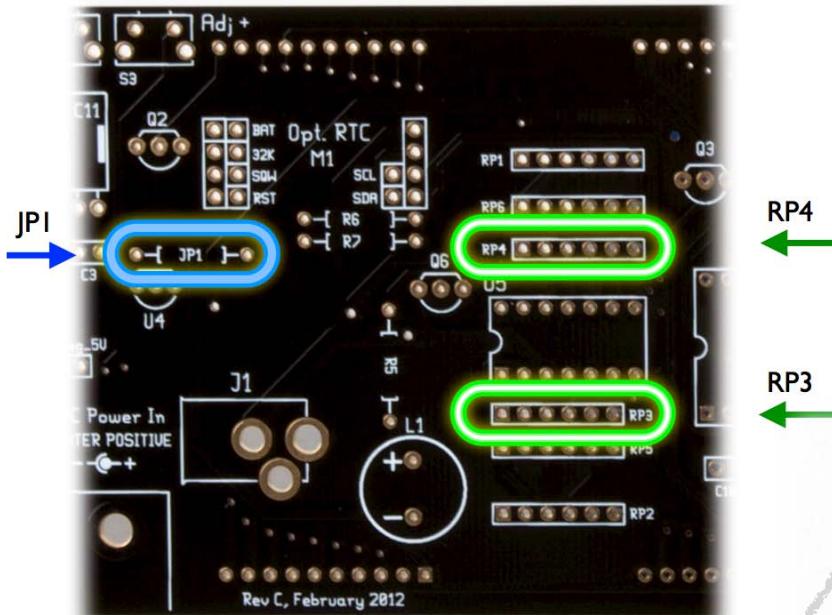
Assembly Step 9 - Resistor packs.



If you are building a **WHITE** or **BLUE** Alpha Clock Five, skip ahead to the next page, Step 9B.

For **RED** Alpha Clock Five only:

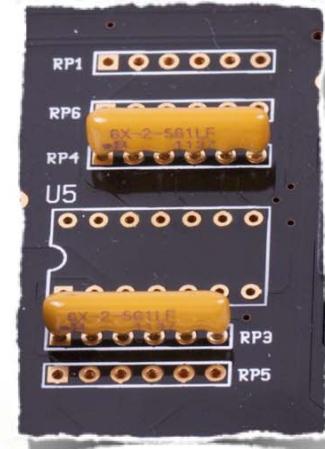
Highlighted here are the component locations for JPI, RP3, and RP4 on the circuit board:



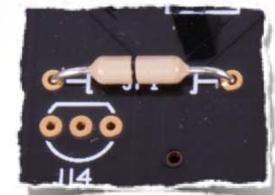
Parts #6 are two 560 ohm resistor packs.

Insert them into locations RP3 and RP4, and solder all six pins of each into place. (The orientation does not matter.)

You may find it helpful to slightly bend out one or two of the pins of each, on the bottom side, to hold them in place while you solder.

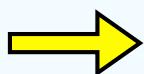


Part #7 is a single "zeroohm" jumper; it looks like a resistor with a single black stripe. Install it, as you would a resistor, at location JPI.



After installing these three components, advance to Step 10, skipping Step 9B.

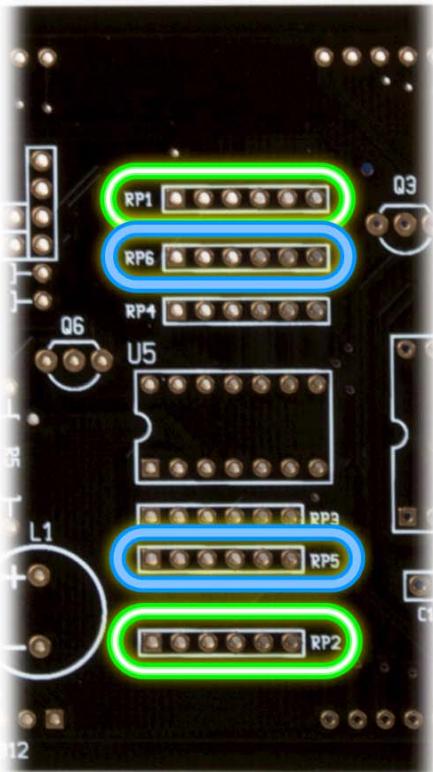
Assembly Step 9B - Resistor packs.



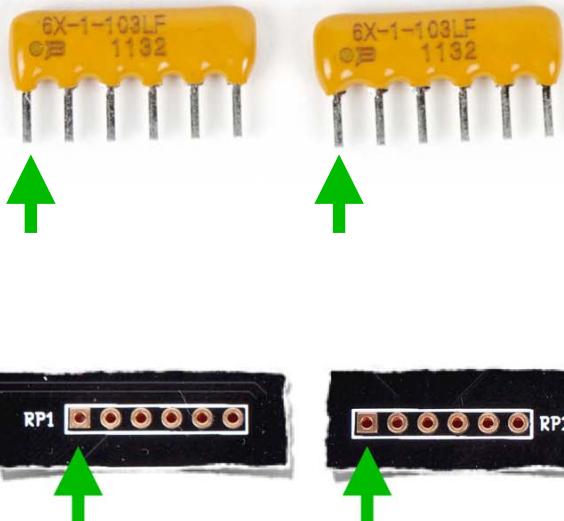
If you are building a **RED** Alpha Clock Five,
skip ahead to the next page, Step 10.

For **WHITE** or **BLUE** Alpha Clock Five only:

Highlighted here are the component locations for RP1, RP2, RP5, and RP6 on the circuit board:



Parts **#6** are two 10 k ohm (yellow) resistor packs:



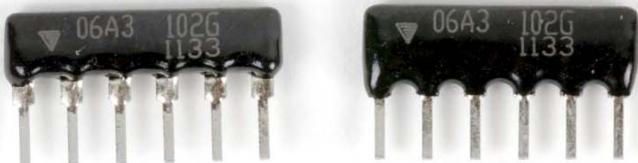
On each of the **#6** resistor packs, locate “Pin 1,” which is marked by a little circle on the body of the resistor pack’s body.

These two components go into locations RP1 and RP2 on the circuit board. Note however, that you need to place them with a specific orientation: “Pin 1,” of each resistor pack needs to be inserted into the “Pin 1” hole of locations RP1 and RP2.

The “Pin 1” holes are the ones with the *square pads*, indicated here with arrows.

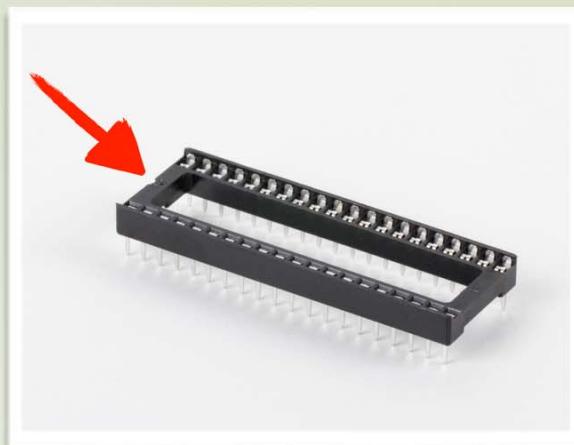
After inserting parts **#6** with the correct orientation, solder all six pins of each into place. You may find it helpful to slightly bend out one or two of the pins of each, on the bottom side, to hold them in place while you solder.

Parts **#7** are two 1 k ohm resistor packs:

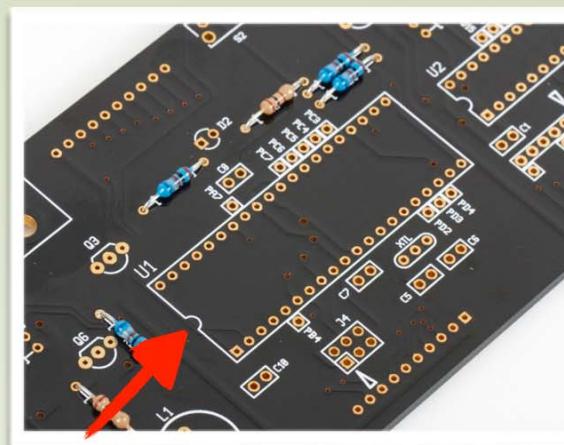


For these resistor packs, the orientation does not matter. Insert them into locations RP5 and RP6, and solder all six pins of each into place in the same way as for parts **#6**.

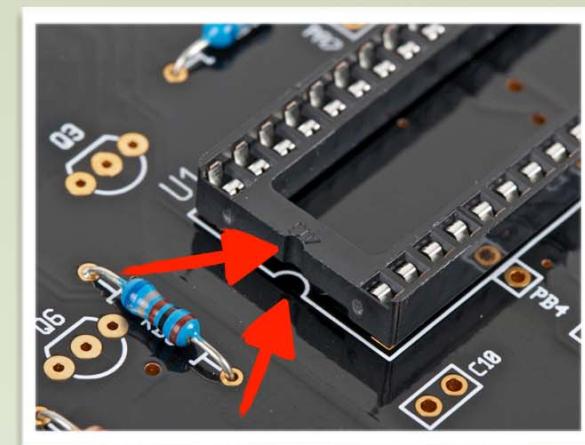
Assembly Step 10 – The 40-pin IC Socket



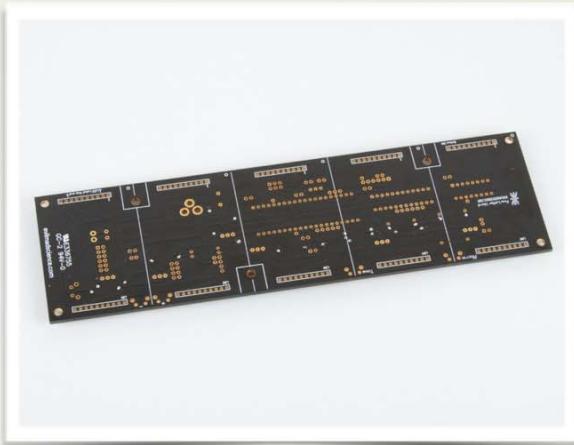
This is #8, the 40-position socket for the microcontroller. Locate the polarity marking notch at one end of the socket.



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



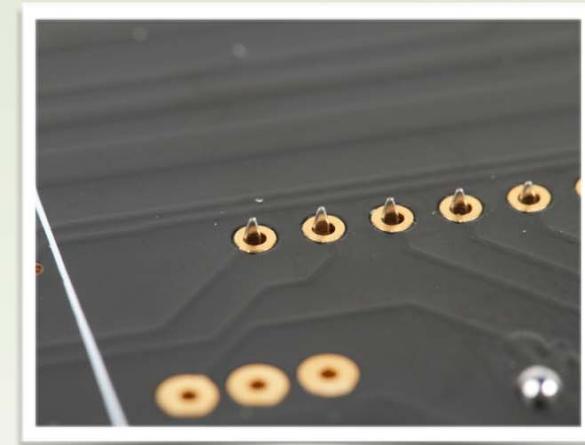
Insert the socket into the circuit board, matching the two ends with the notches.



Flip the circuit board over, while keeping the socket in place.

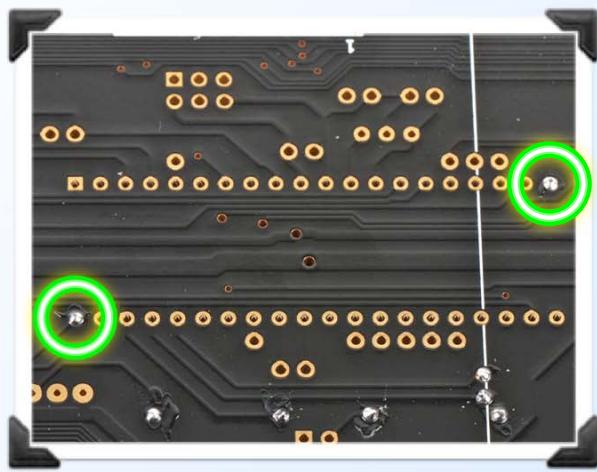


To ensure good positioning, rest the circuit board flat on top of the socket.

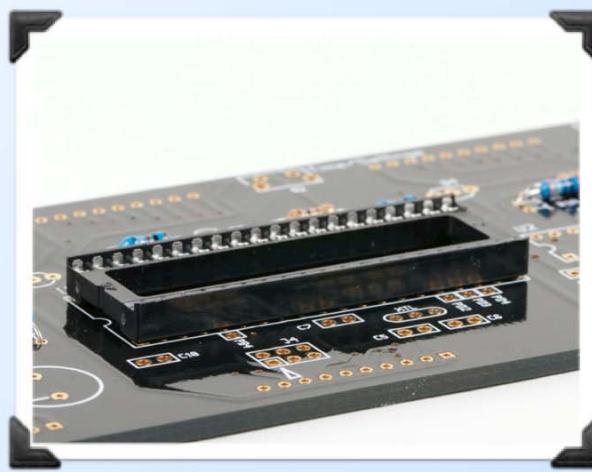


The socket pins will protrude (but only very slightly) through the circuit board

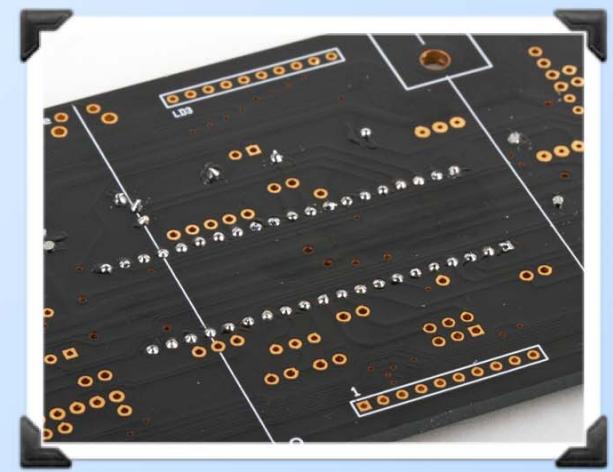
Assembly Step 11 – Sockets, continued



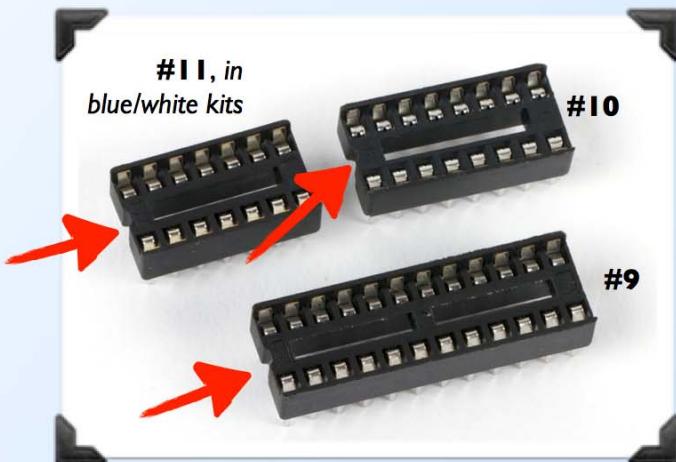
To begin with, solder just two opposite corner pins of the 40-pin socket.



Then, on the top side, check that the socket is level and flush to the board.

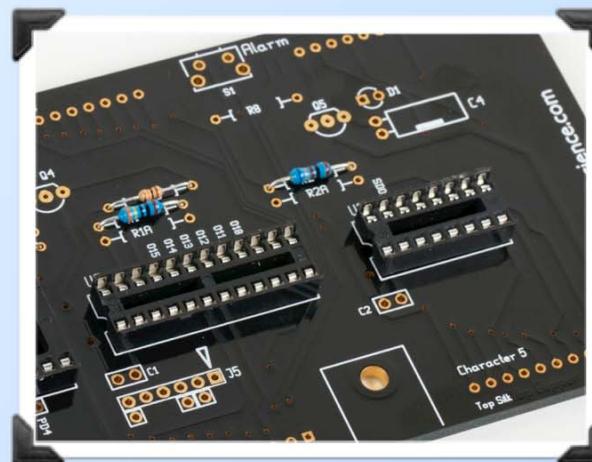


Then, solder the rest of the socket pins.

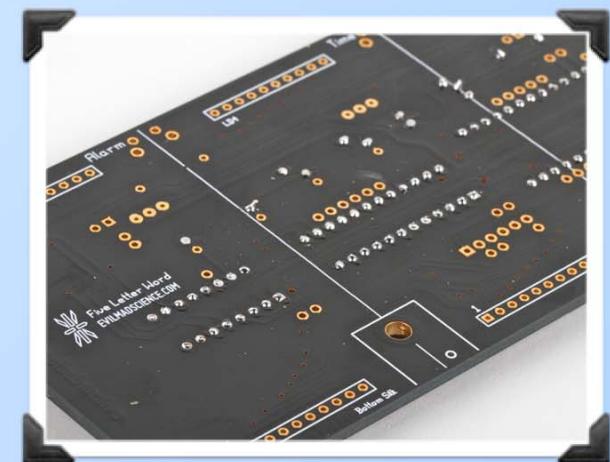


Parts **#9** and **#10** are 24-pin and 16-pin DIP Sockets, respectively. Blue/White Alpha Clock Five kits also include a **#11**, a 14-pin DIP socket.

Note that each has a notch at one end to mark the polarity.



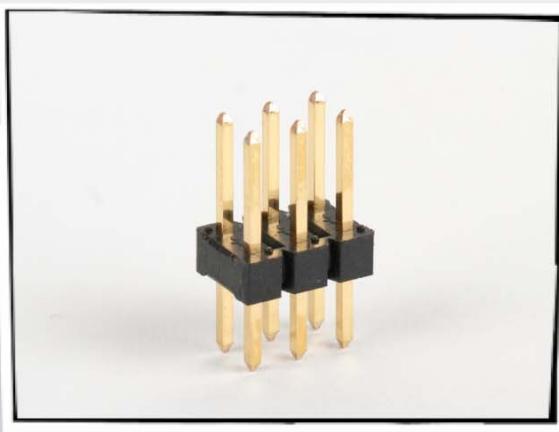
One at a time, install the DIP sockets in locations U2 and U3 (as well as U5, if building a Blue or White kit), using the same method used for the 40-pin socket. Again take care to match the notches to those on the circuit board



As before, solder all of the pins on the back side.

(And, do not insert any of the chips just yet— we'll do that later.)

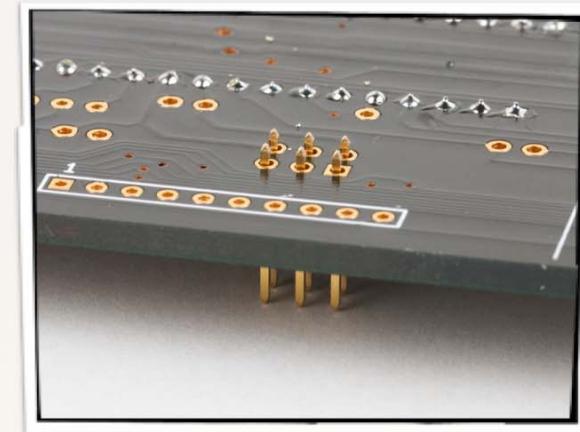
Assembly Step 12 – Six-pin DIL ISP Header



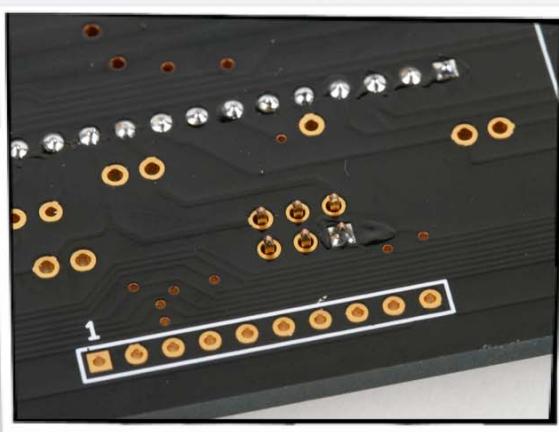
Part #12 is a 6-pin DIL (dual inline) header.



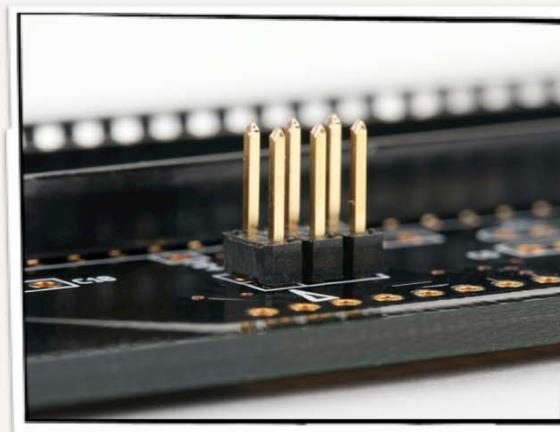
It goes in location J4.



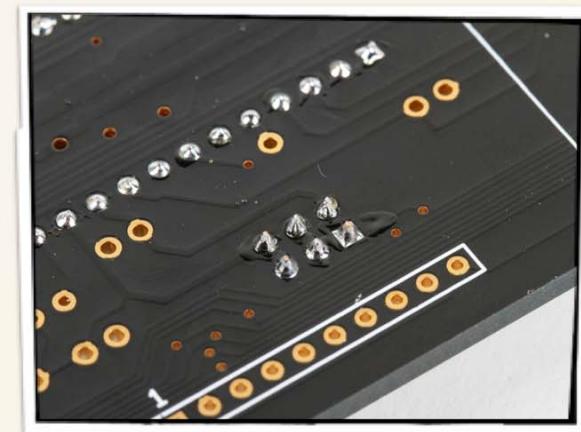
Flip the board over, so that you can rest it on the header, to hold it in place while soldering.



Solder just one pin to begin with.



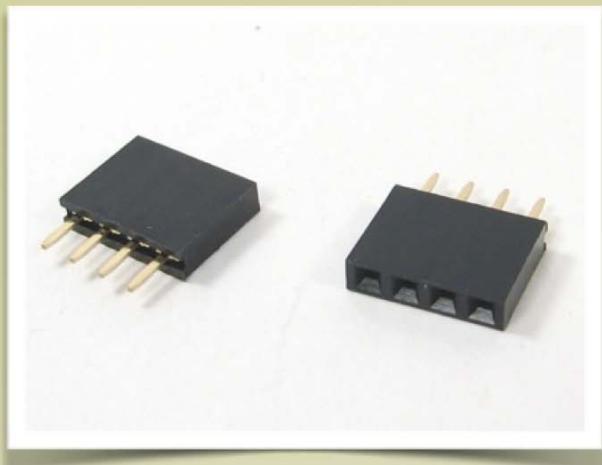
On the top side, make sure that the header sits flush to the circuit board. If not, flip it back over, and melt the joint while pressing down on the circuit board, to snap the header into place.



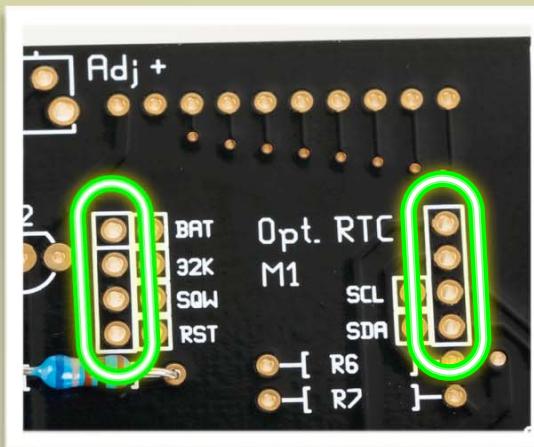
Then, solder the other five pins.

Assembly Step 13 – RTC Sockets

In this step, we add the sockets that allow Alpha Clock Five to be connected to a real-time clock module (e.g., Chronodot)



Parts #13 are two 4-pin female headers that go at location M1.



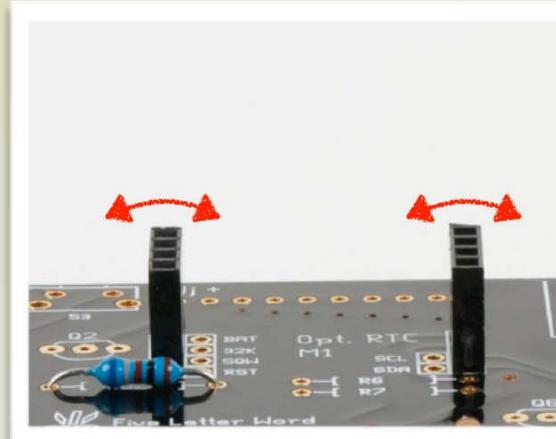
There are actually two rows of holes at M1. Note that the headers go in the outer positions.



Insert the two headers...



...And flip the board over to rest on them, holding them in place for soldering. Solder one pin of each header.



On the top side, straighten the headers, and make sure that they are flush and square to the board.



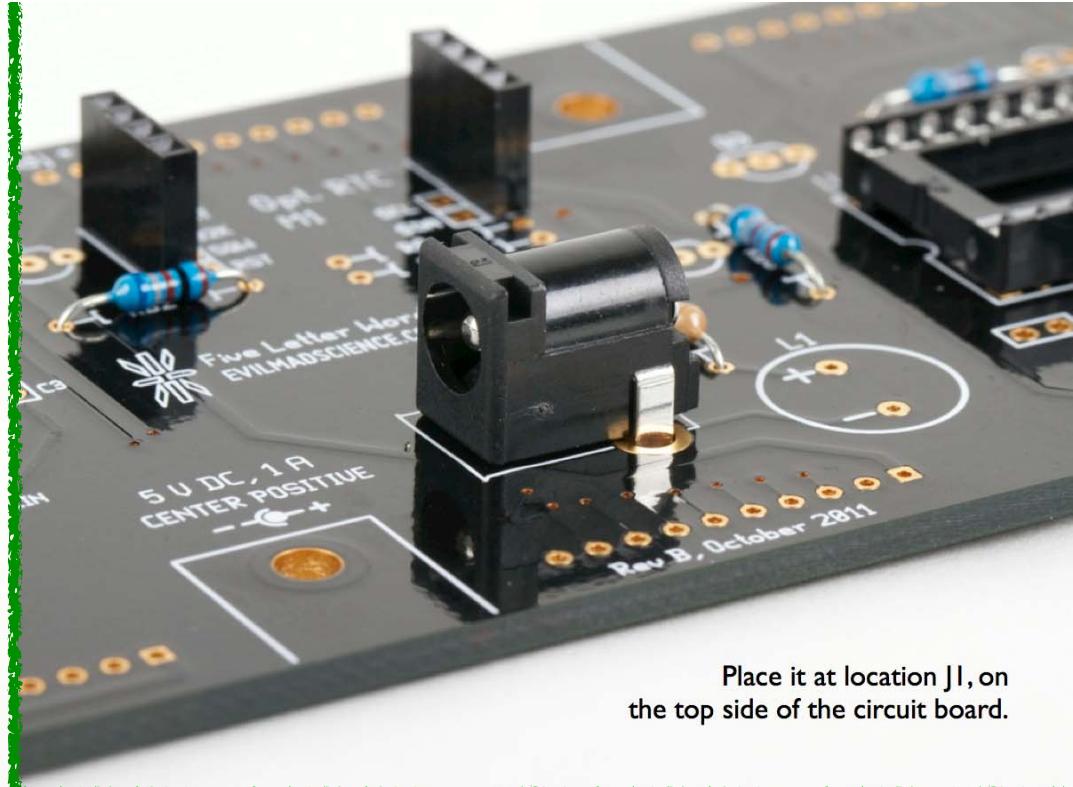
Finally, solder the other three pins of each header.

Assembly Step 14 – Power jack



Part #14 is the dc power jack.

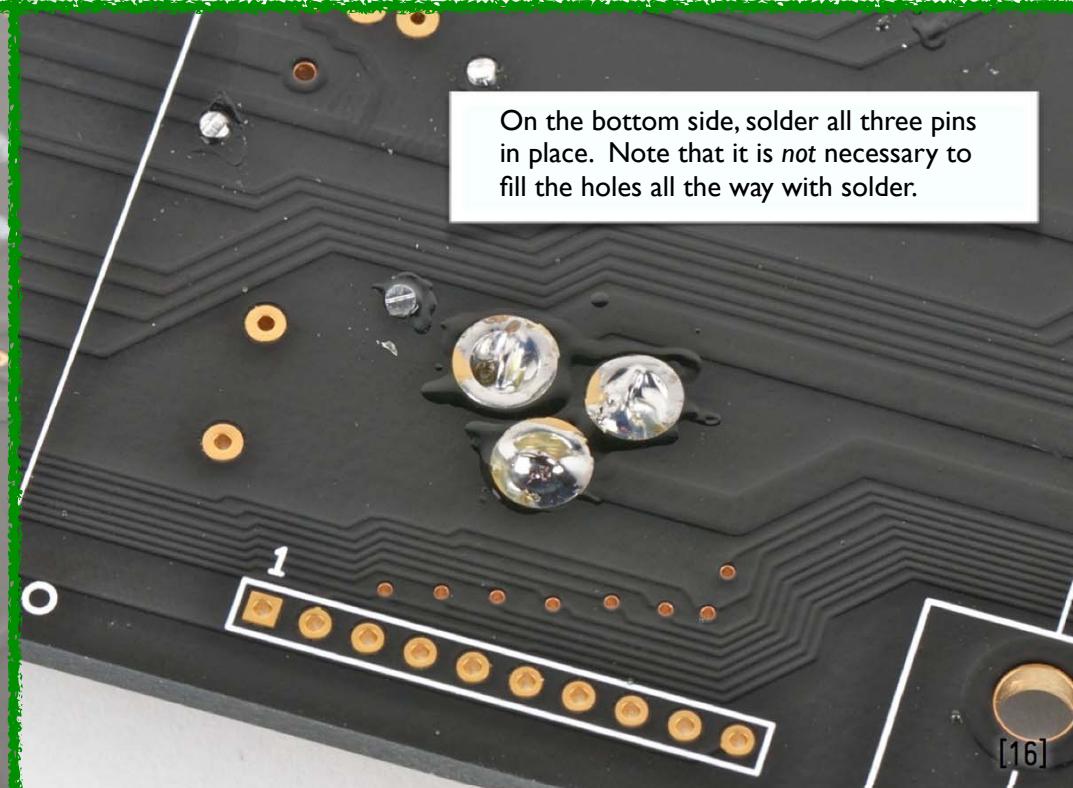
(Red Alpha Clock Five kits include a 2.5 x 5.5 mm jack, while Blue/White Alpha Clock Five kits include a 2.1 x 5.5 mm jack.)



Place it at location J1, on the top side of the circuit board.

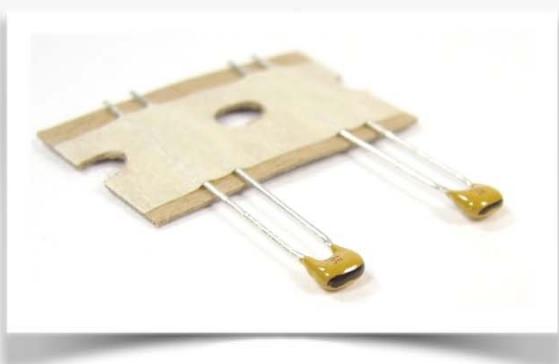


Solder one pin of the connector—the side pin—to hold it in place. The larger metal here can take a while to heat, up to about 8 s.



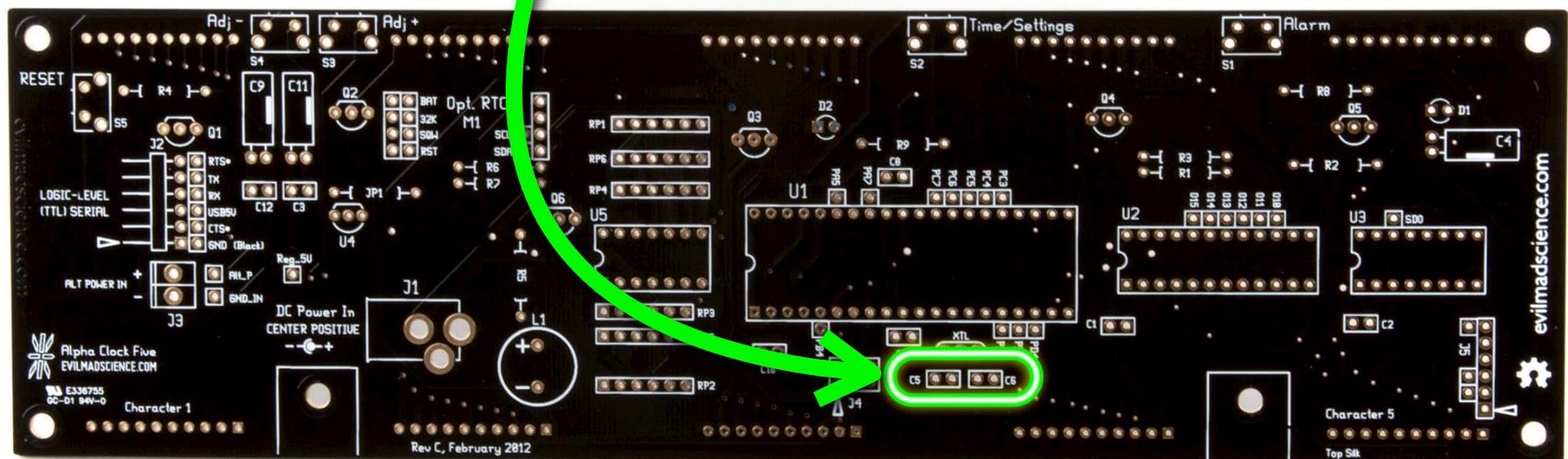
On the bottom side, solder all three pins in place. Note that it is *not* necessary to fill the holes all the way with solder.

Assembly Step 15 – 18 pF capacitors



Parts #15 are two little 18 pF ceramic capacitors— little yellow beads with two pins. There are two similar types of ceramic capacitors in the kit, so these ones are marked with a *black stripe*.

Solder these two capacitors on the board at locations C5 and C6.

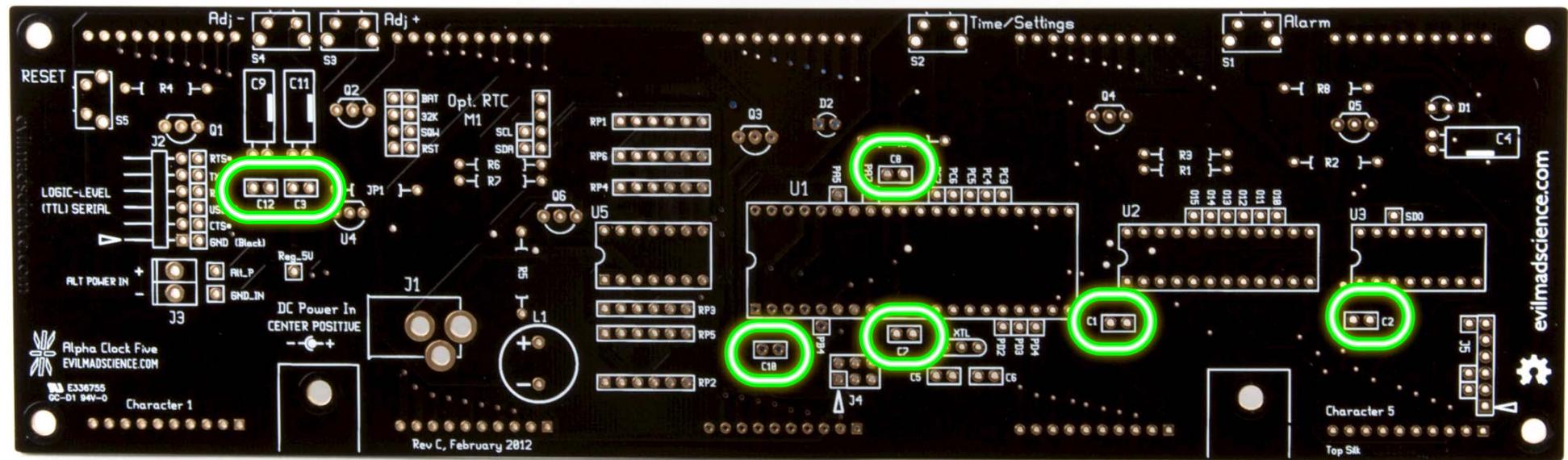
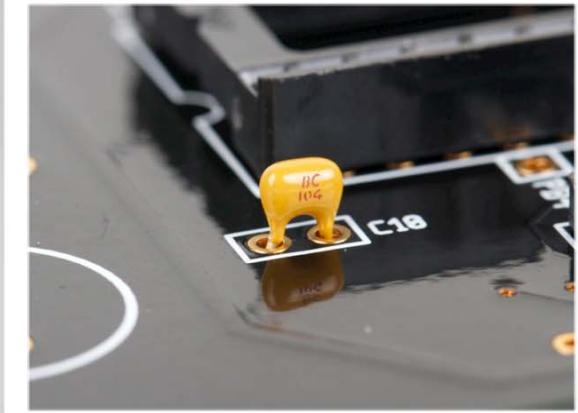


Assembly Step 16 – 0.1 uF capacitors

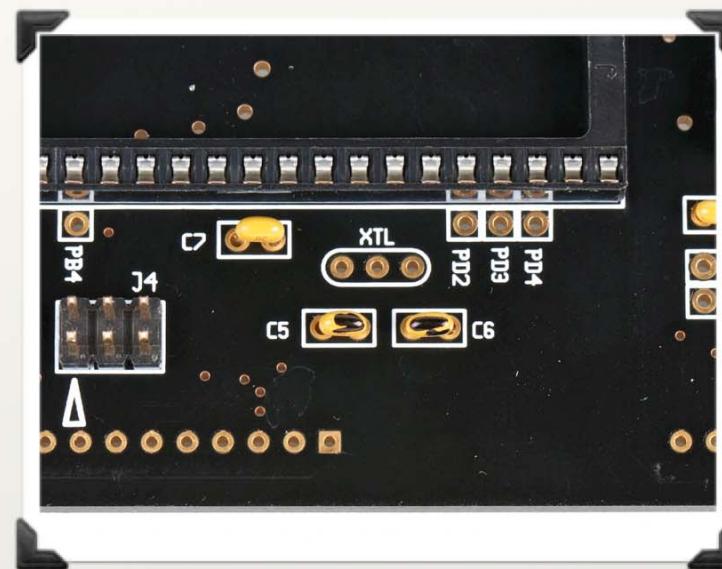


Parts #16 are similar looking 0.1 uF ceramic capacitors, but there are more of them, and without the black stripe.

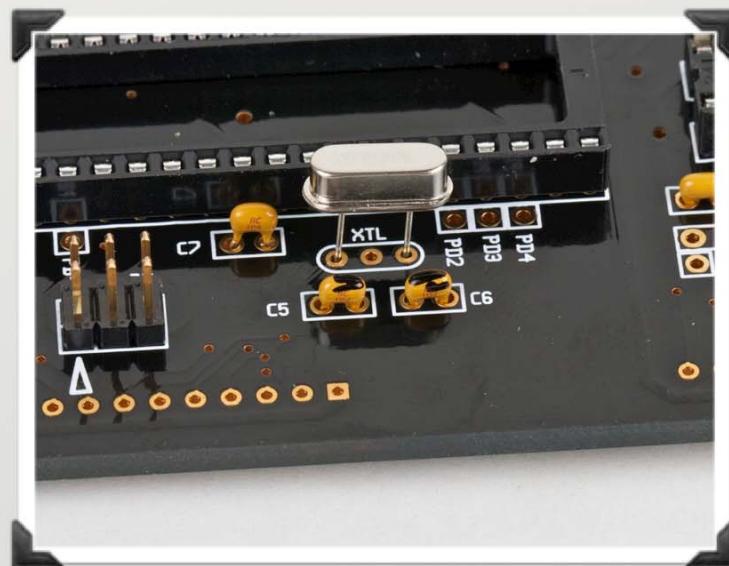
- For **Red** Alpha Clock Five:
Install six of these capacitors in locations:
C1, C2, C3, C7, C8 and C10.
- For **BLUE / White** Alpha Clock Five:
Install seven of these capacitors in locations:
C1, C2, C3, C7, C8, C10, and C12



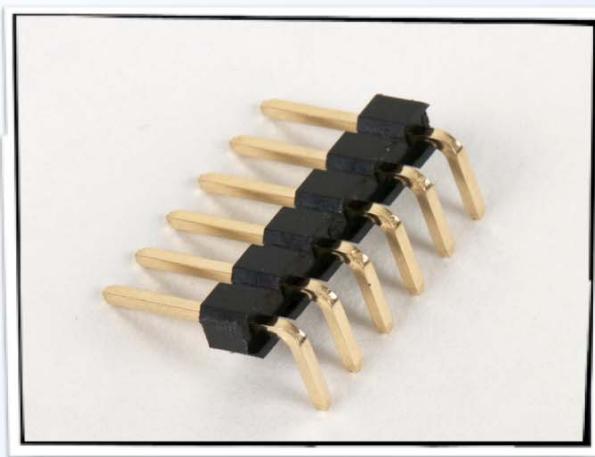
Assembly Step 17 – Quartz Crystal



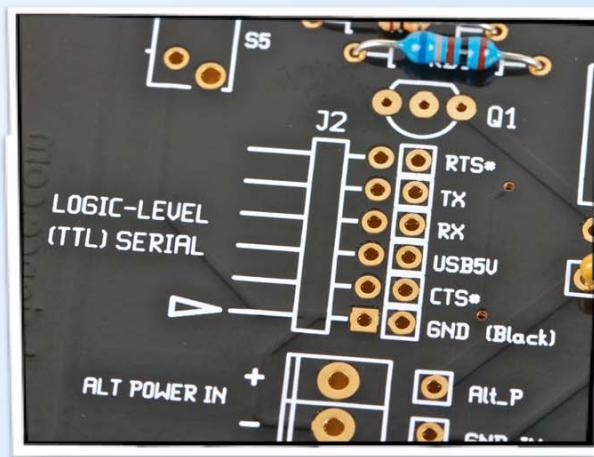
Install part #17, a 16 MHz quartz crystal.
Its two pins go in the outer two holes of the location marked
“XTL.” Solder both pins in place, much like a resistor.



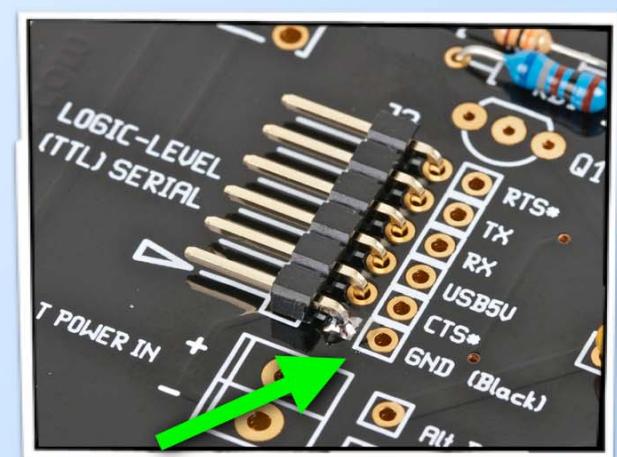
Assembly Step 18 – Six pin SIL RA Headers



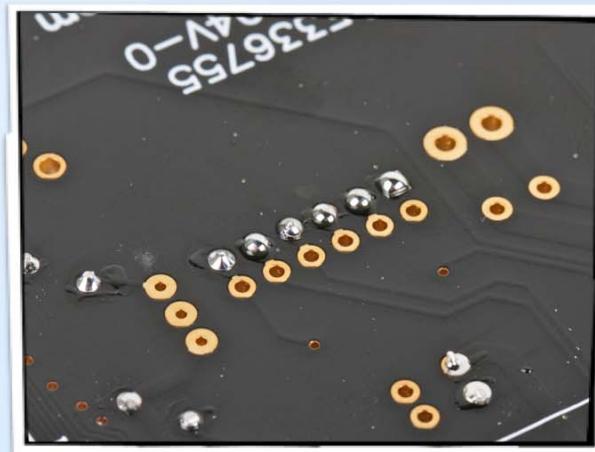
Parts #18 are six-pin single-inline (SIL) right-angle (RA) headers.



The first one goes in location J2 on the circuit board, oriented so as to match the drawing on the circuit board.



Set the header in place, and tack it there by soldering one of the pins on the top side of the board.



Then, on the bottom side, solder all six pins in place.

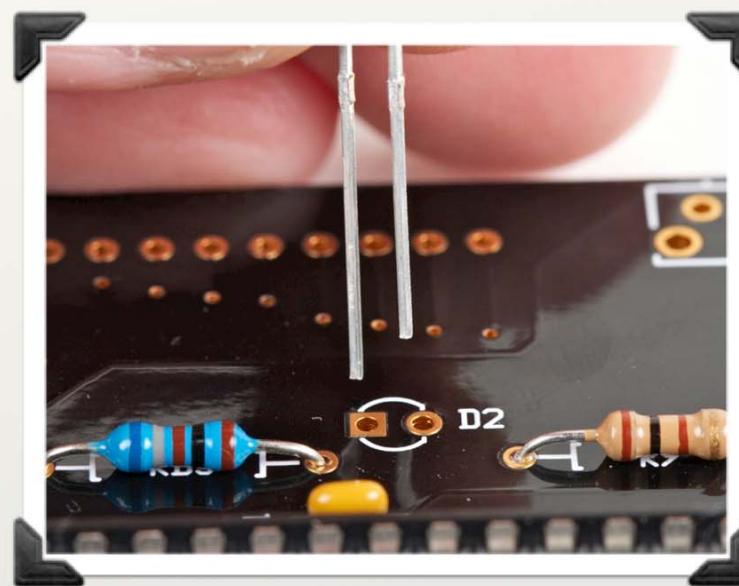


Repeat the procedure to add a second header at location J5, with the pins facing towards the edge of the board as shown.

Assembly Step 19 – The Night Light



Part #19 is a small white LED.
Note that this component has
one long lead and one short lead.

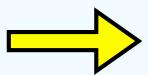


Install the LED in location D2, near the top-middle of the board.

Orientation matters: The long lead of the LED goes into the square hole of location D2.



Assembly Step 20 - Identify Regulator.



If you are building a **RED** Alpha Clock Five, skip this step, and advance to the next page, Step 21.

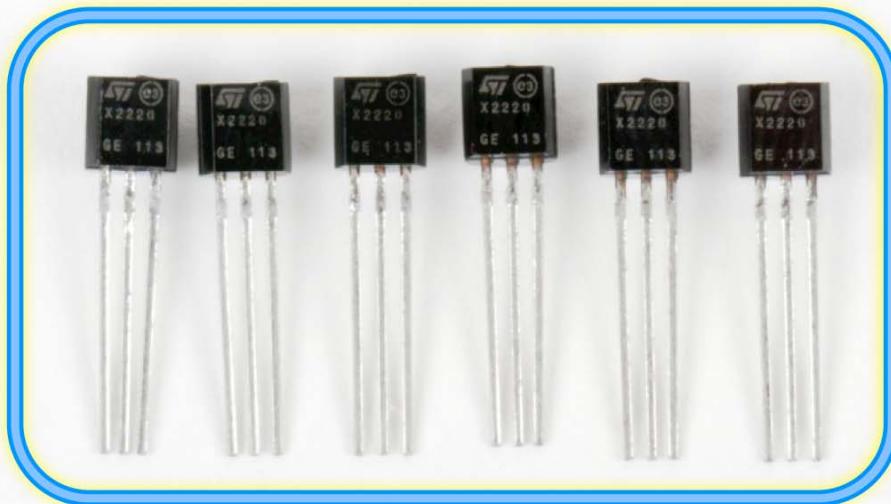
For **BLUE** or **WHITE** Alpha Clock Five only:

Here are two different, but similar looking components in the kit: The six transistors (#20) and the voltage regulator (#21).

In the next step (Step 21), you will install the six transistors. So, at this time identify the one voltage regulator and set it aside, leaving you with those six transistors for the next step.



Voltage Regulator
(#21)



Transistors (#20), quantity 6

Voltage Regulator
(#21)



Identification:

- Markings include “750L05”
- Sideways text
- Only one of them

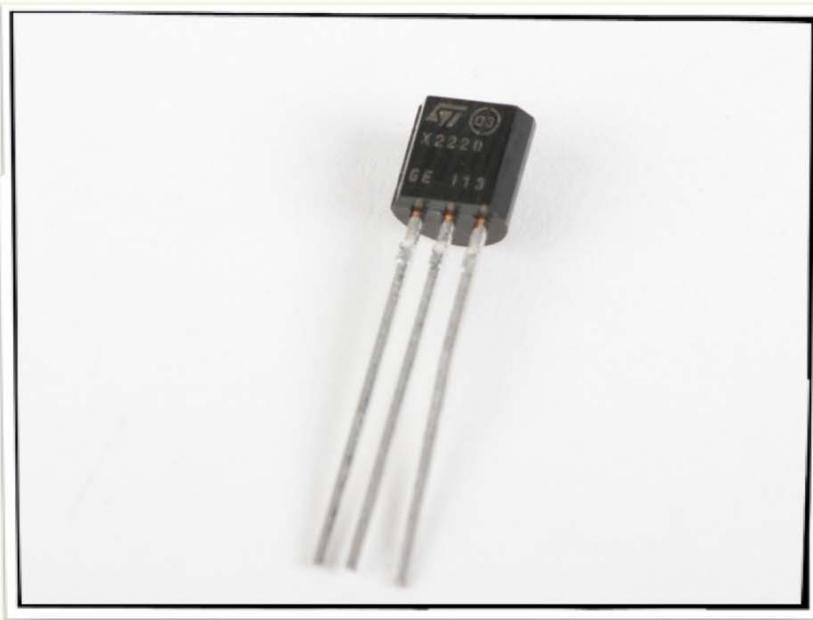
Transistors
(#20)



Identification:

- Markings include “X2220”
- Vertical text
- Six of these

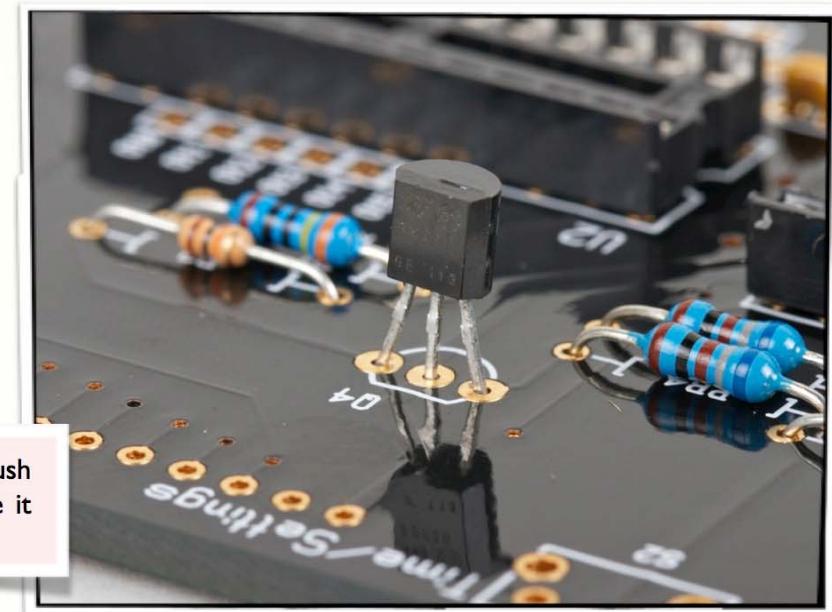
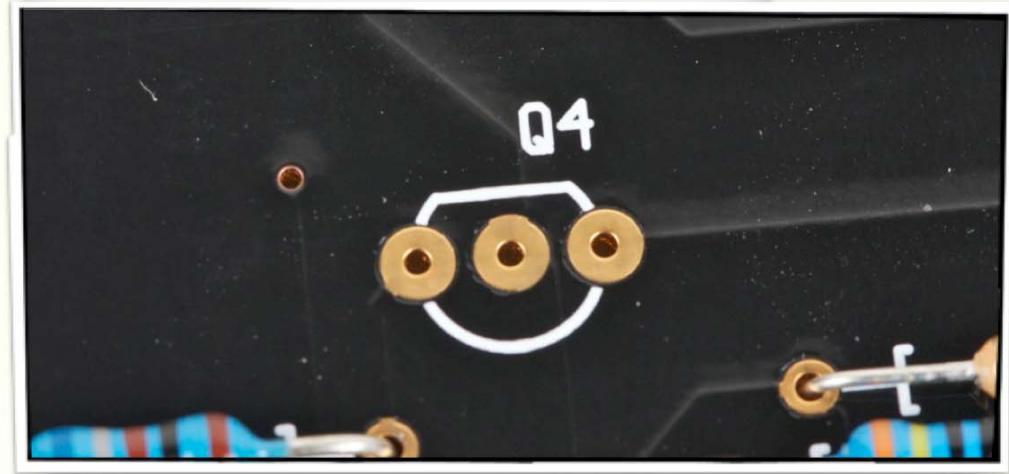
Assembly Step 21 – The Transistors



Parts #17 are PNP transistors. There are six of these, that go in locations Q1 – Q6.

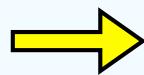
Note that each transistor has one flat face.

Install all six transistors, matching the orientation of that flat face to the outline on the circuit board and then soldering them into place.



Note that the transistors do not seat fully flush to the circuit board, but rather slightly above it like so. Do not force them down further.

Assembly Step 22 - Voltage Regulator.



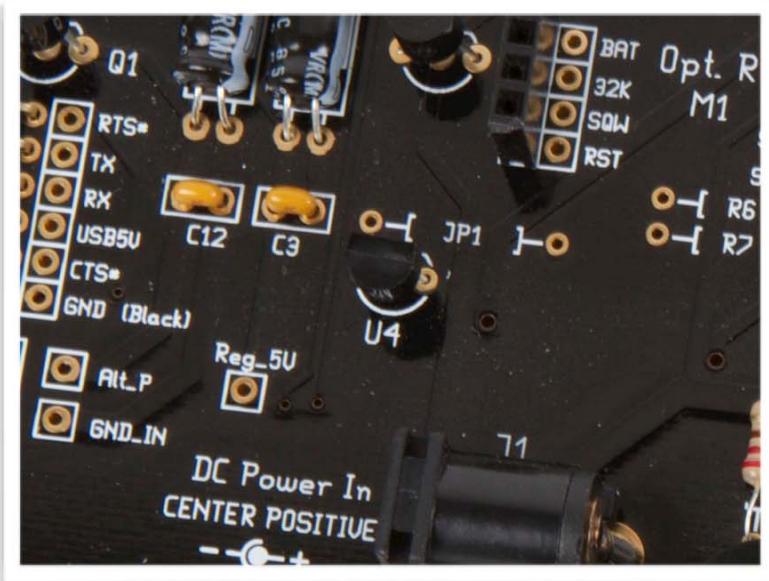
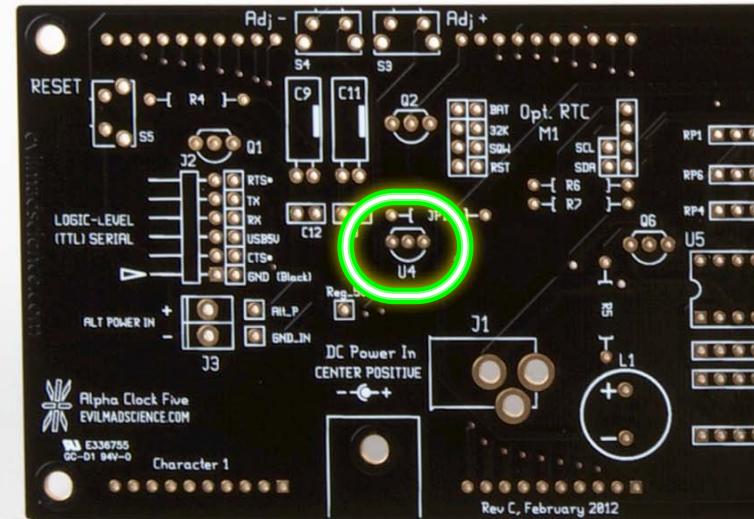
If you are building a **RED** Alpha Clock Five, skip this step and advance to the next page, Step 23.

For **BLUE** or **WHITE** Alpha Clock Five only:

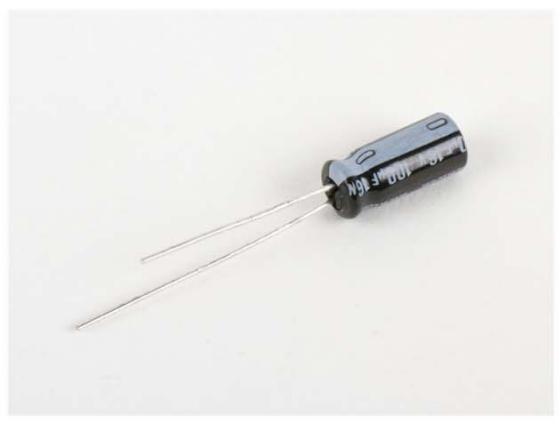


Part #21 is the voltage regulator that you identified in Step 20. It goes in location U4.

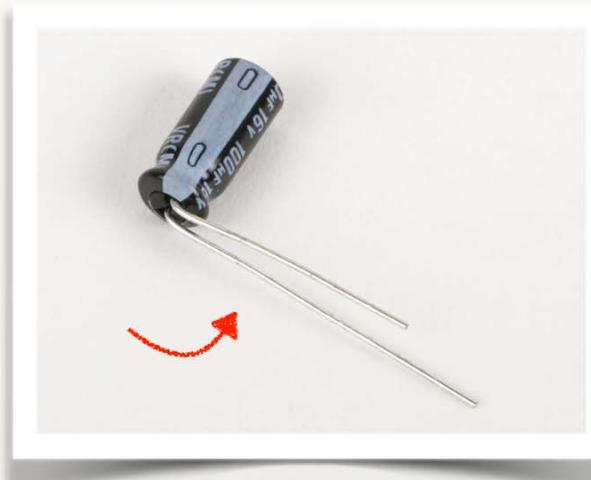
To install it, follow the same procedure that you used with the transistors in the last step: Match the flat face of the regulator to the outline on the circuit board and solder it into place.



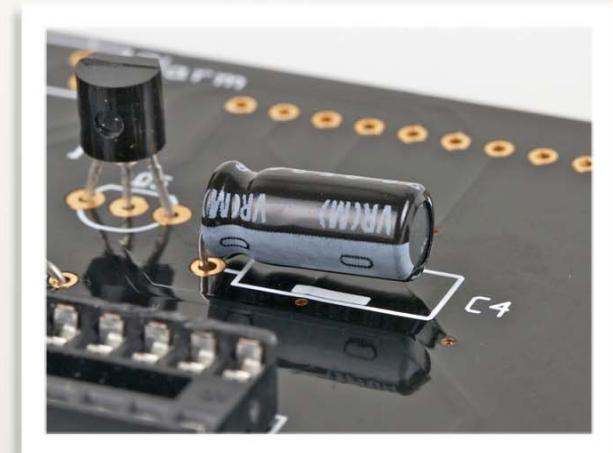
Assembly Step 23 – Electrolytic capacitors



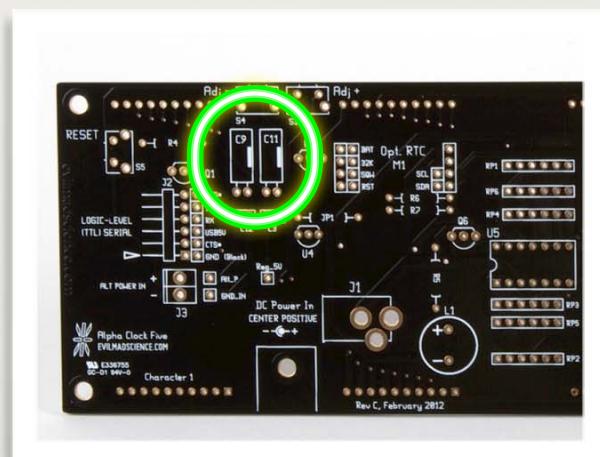
Parts #22 are aluminum electrolytic capacitors; small cylinders with printed plastic wrappers.



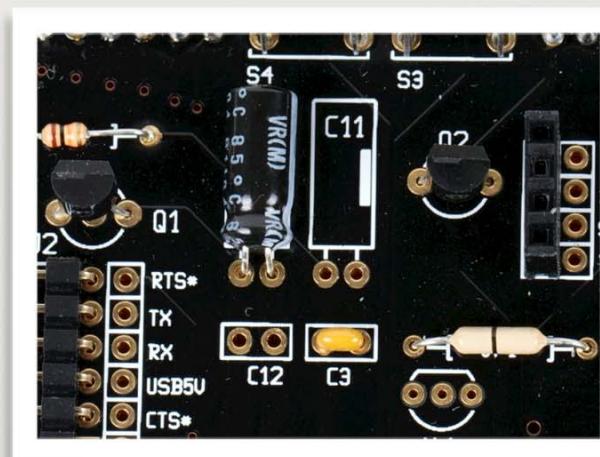
One side of each capacitor has a broad white stripe, marked “–”, as a polarity indicator. With the “–” side facing up, bend the leads down as shown.



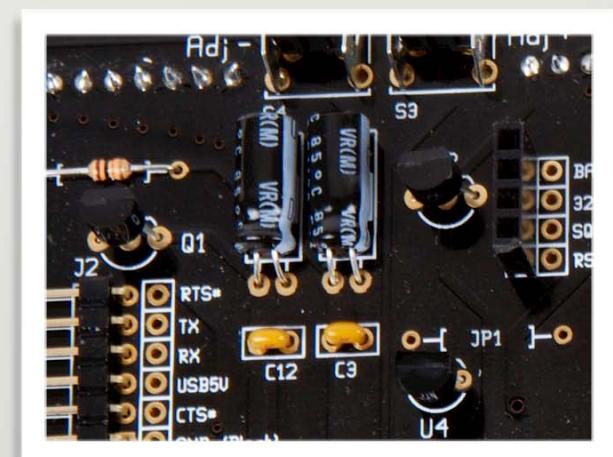
Solder in the first capacitor at location C4, in the upper right corner of the board. Make sure that the “–” side of the capacitor faces the “–” stripe on the circuit board, as shown above.



What comes next depends on the color of your kit...



For Red Alpha Clock Five Kits:
Install one more capacitor into location C9.
Leave C11 unpopulated.



For Blue or White Alpha Clock Five Kits:
Install two more capacitors at locations
C9 and C11.

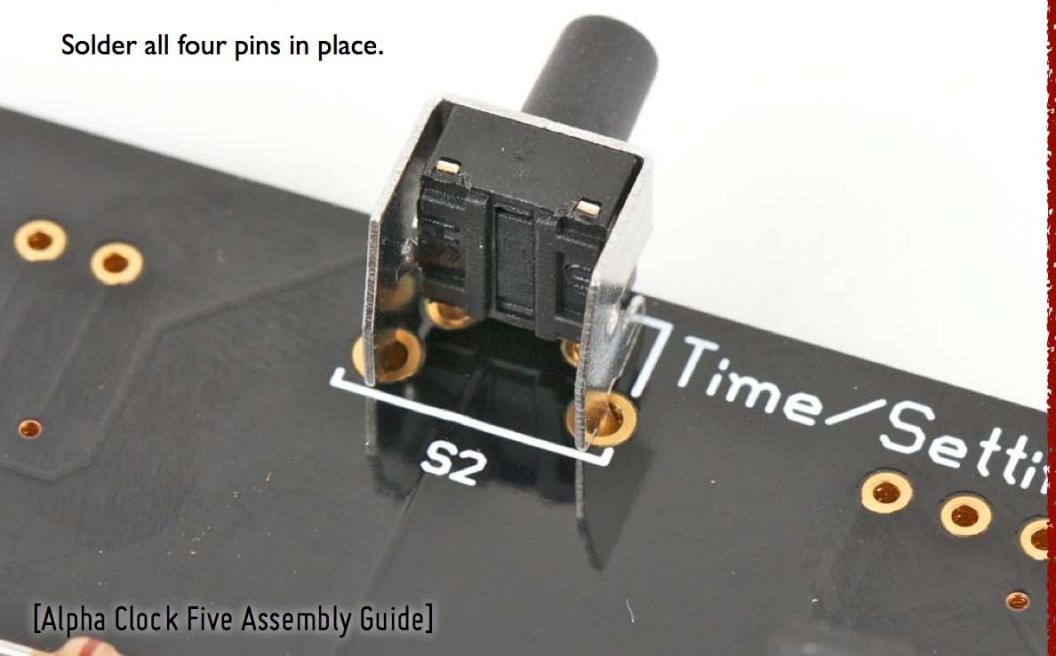
Assembly Step 24 – Button switches

Parts #23 are right-angle tactile button switches.

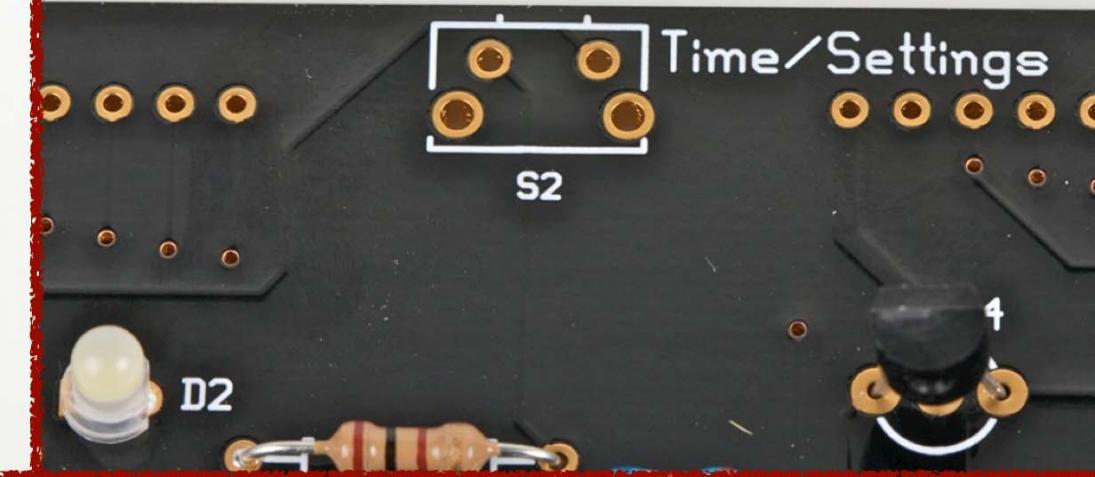


“Snap” the button into the location, and make sure that it sits fully flush to the board.

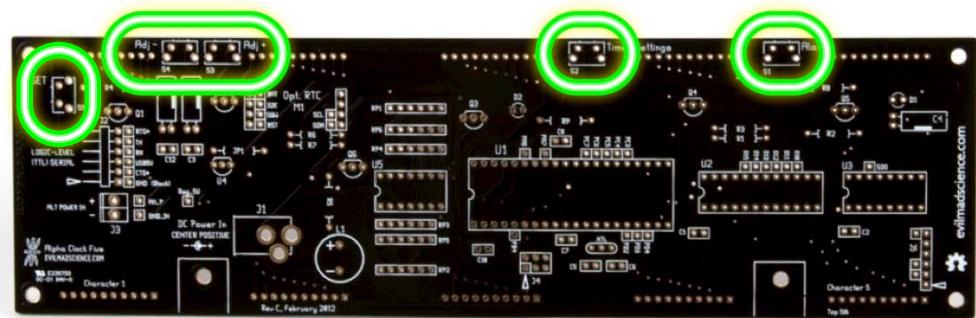
Solder all four pins in place.



Here is what one of the button locations looks like:

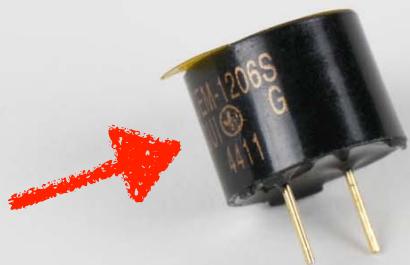


Repeat for each of the switch locations, S1-S5.



Assembly Step 25 – Noise Making Unit

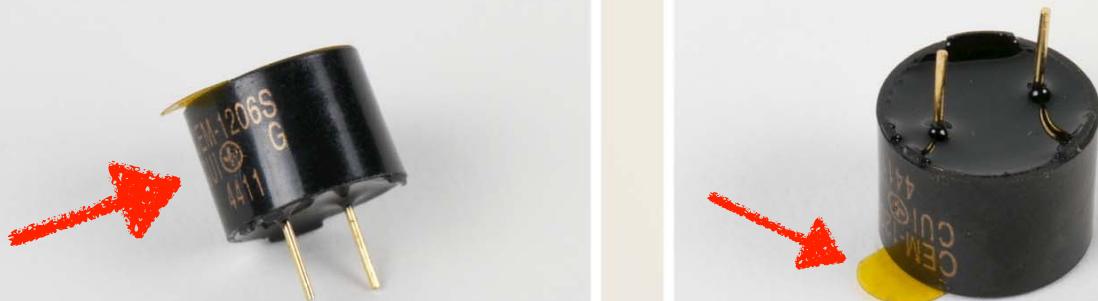
Part #24 is a magnetic speaker/buzzer.



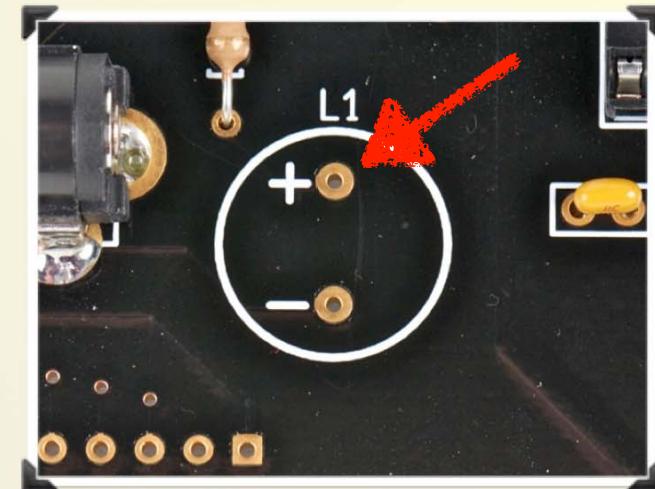
The speaker has a marking on one side ("+"") to indicate its polarity.



Insert the speaker, making sure that the "+" pin goes into the matching "+" hole on the circuit board.



It may also have a piece of yellowish (Kapton) tape that seals the hole on the top.



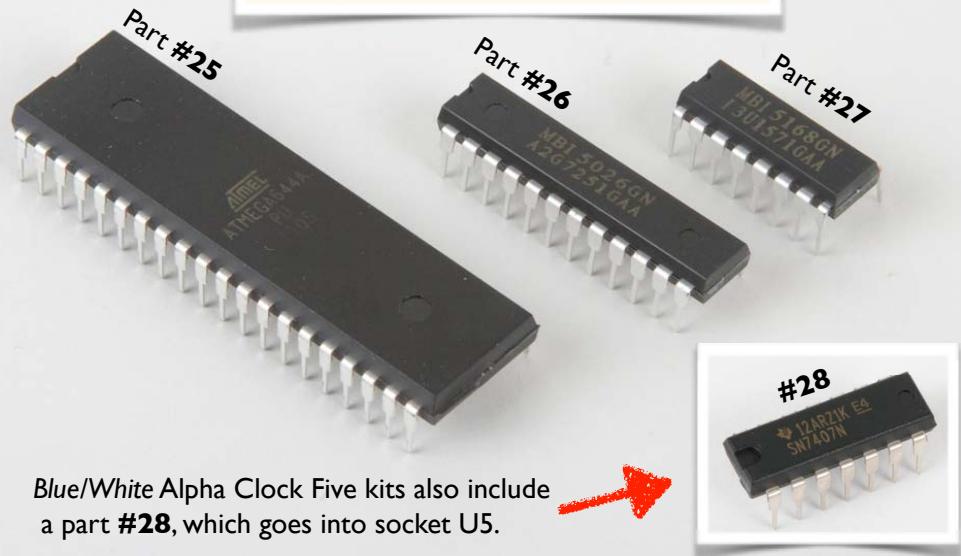
Locate the speaker location, L1, next to the power jack and identify the "+" side.



Solder both pins and clip the leads.
Remove the Kapton tape seal, if present.

Assembly Step 26 – Add the chips

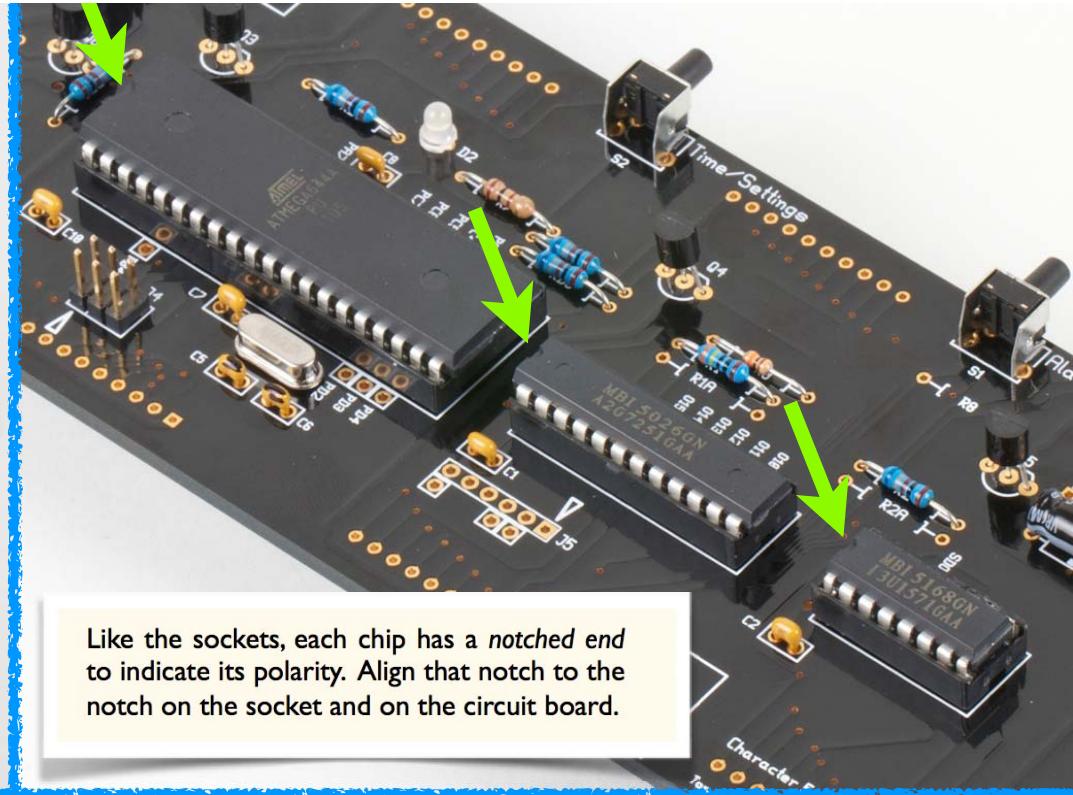
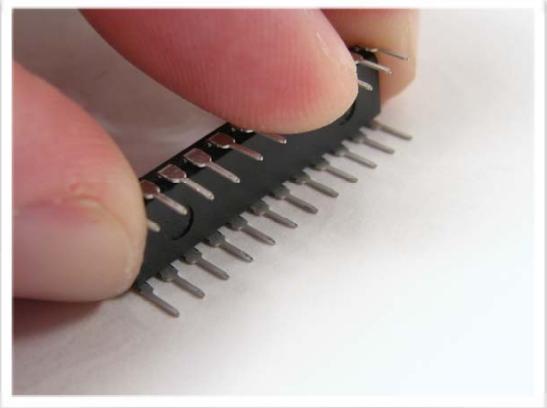
Parts #25-27 are the integrated circuits, which go in sockets U1-U3, respectively.



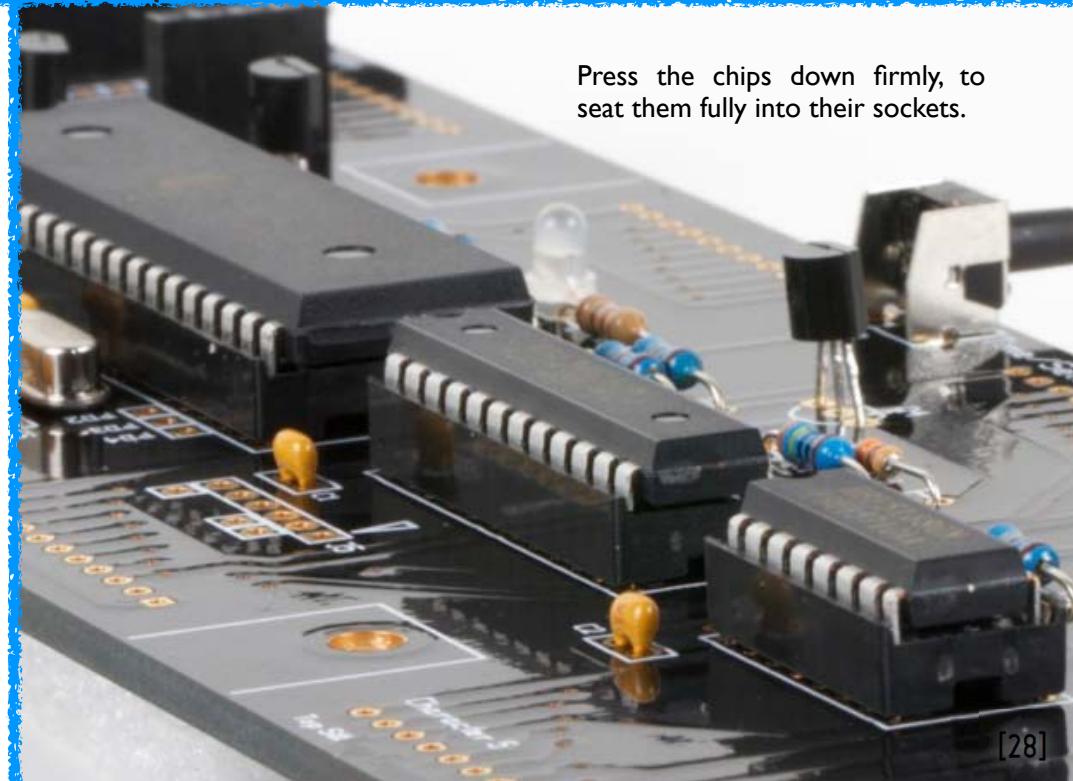
The chips should easily fit into the sockets. If necessary, bend the leads of the chip to straight up and down before inserting the chip.

Do not bend the pins by hand; bend all pins on one side at the same time, by pushing them against a hard flat surface.

View from end of chip:

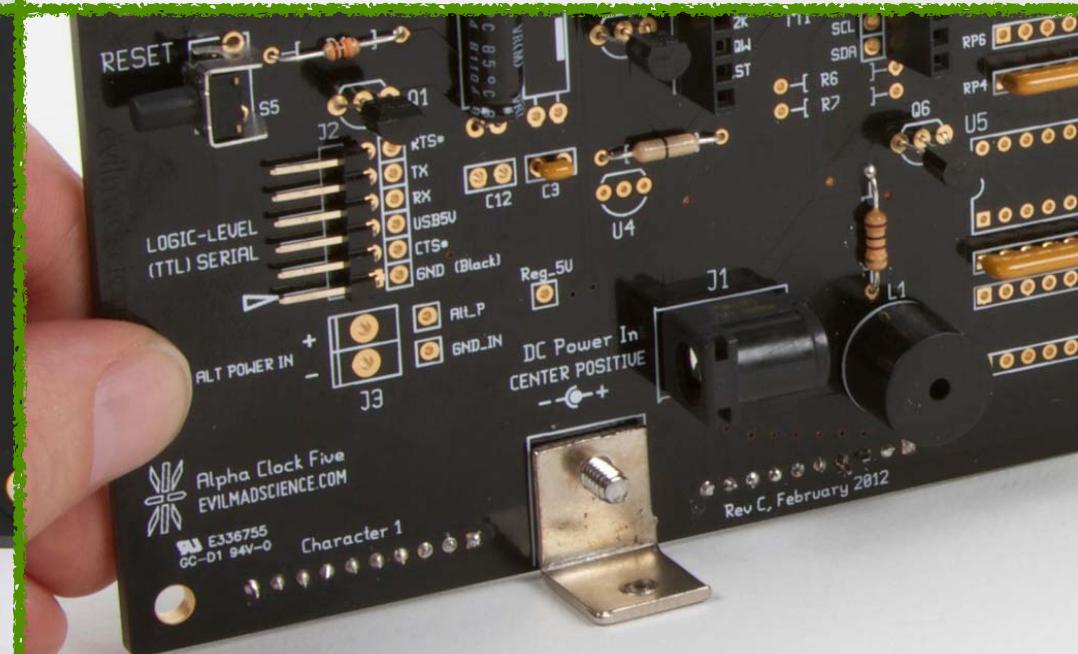
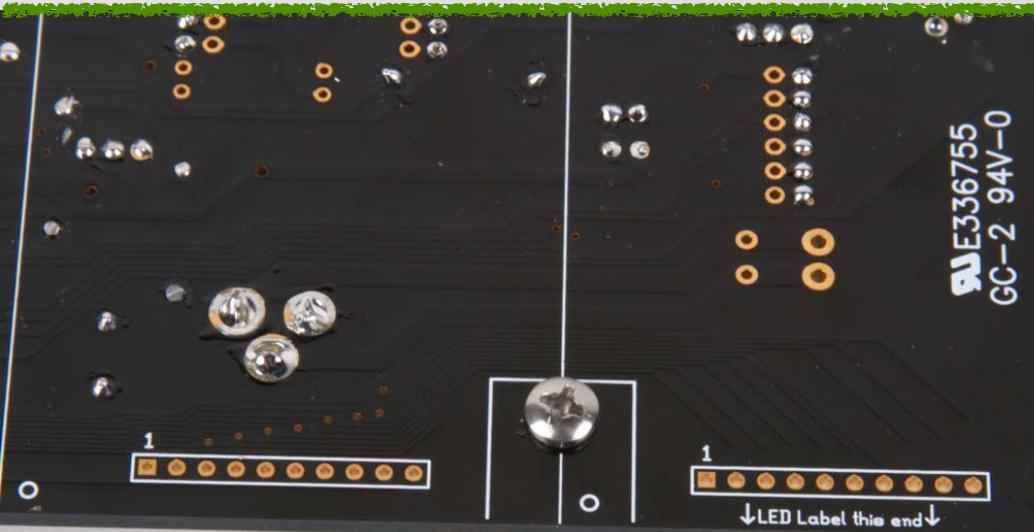
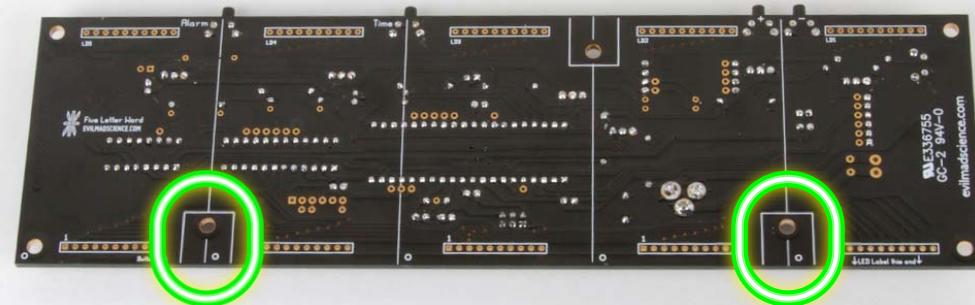


Like the sockets, each chip has a *notched* end to indicate its polarity. Align that notch to the notch on the socket and on the circuit board.



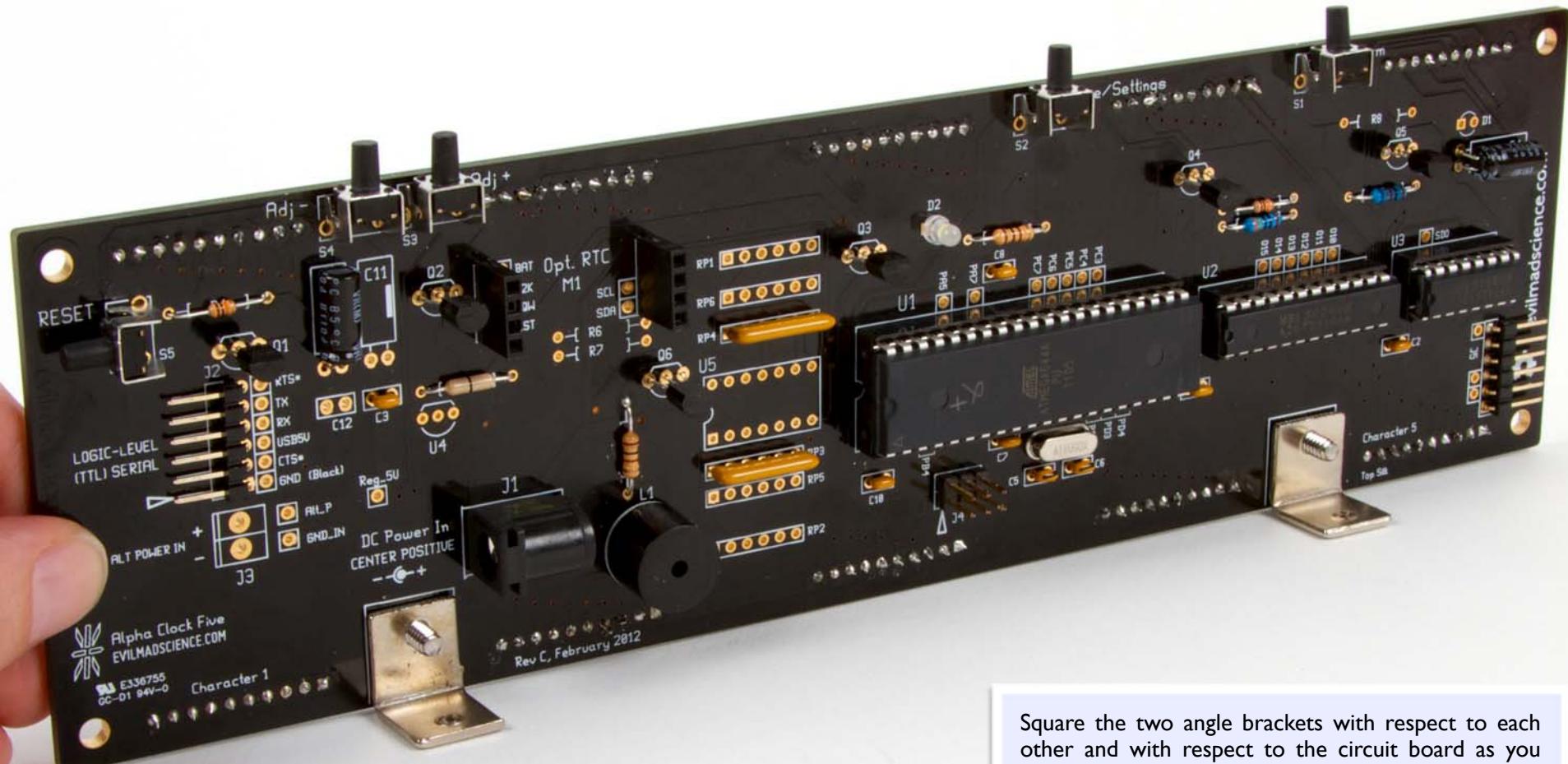
Press the chips down firmly, to seat them fully into their sockets.

Assembly Step 27 – Brackets & Screws



Loosely thread each screw into an angle bracket on the other side of the board.
(Do not tighten them yet.)

Assembly Step 28 – Level the brackets



Square the two angle brackets with respect to each other and with respect to the circuit board as you tighten the screws. It may be helpful to hold the assembly against a hard, flat surface while you do so.

Tighten the screws—very securely—to lock the angle brackets in place.

Assembly Step 29A - The Board So Far

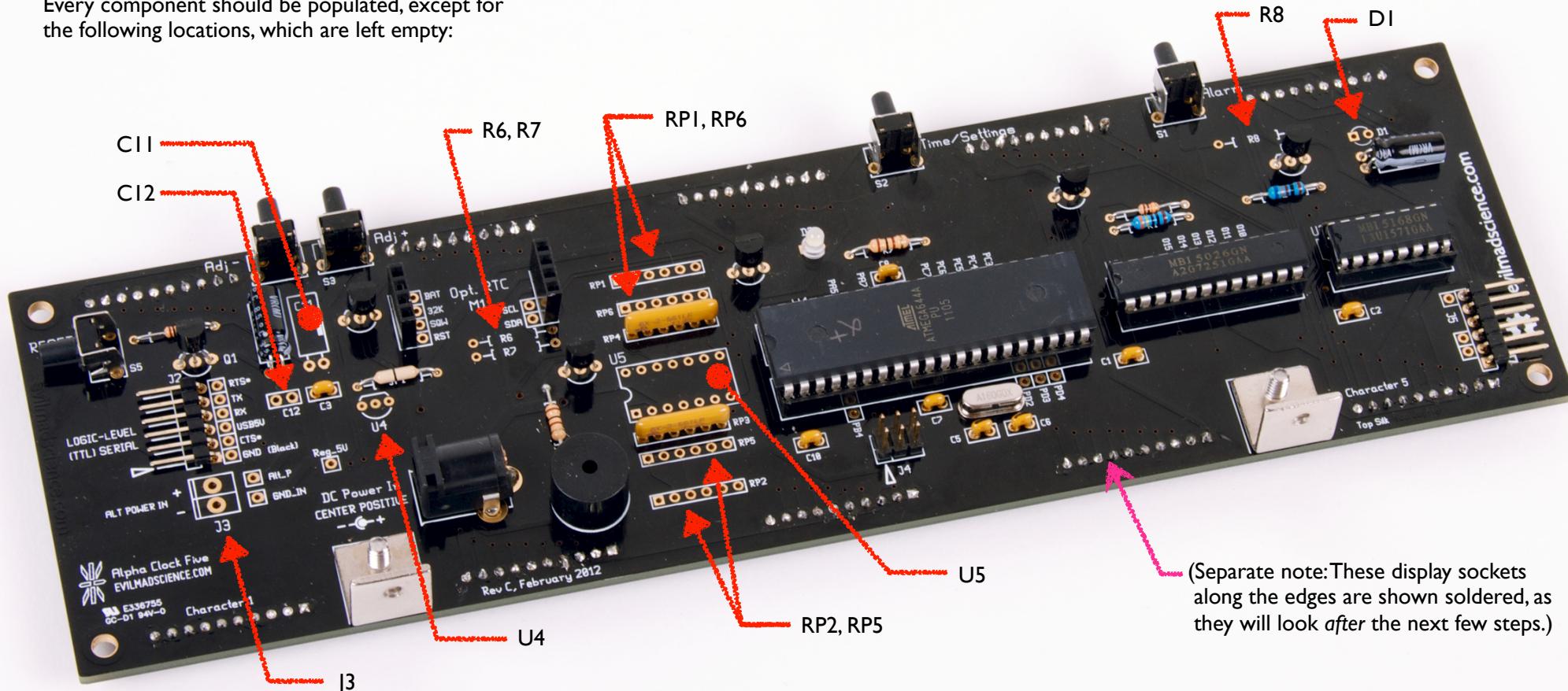
For **BLUE** or **WHITE** Alpha Clock Five kits,
skip ahead to the next page, Step 29B.

For **RED** Alpha Clock Five:

In the next few steps, we'll be adding the five alphanumeric LED displays, which will make it harder to access the back side of the circuit board. So, this is a great time to make sure that everything looks good so far!

Your circuit board should look approximately like this.

Every component should be populated, except for the following locations, which are left empty:



(Separate note: These display sockets along the edges are shown soldered, as they will look after the next few steps.)



Next, advance to Step 30, skipping Step 29B.

Assembly Step 29B - The Board So Far

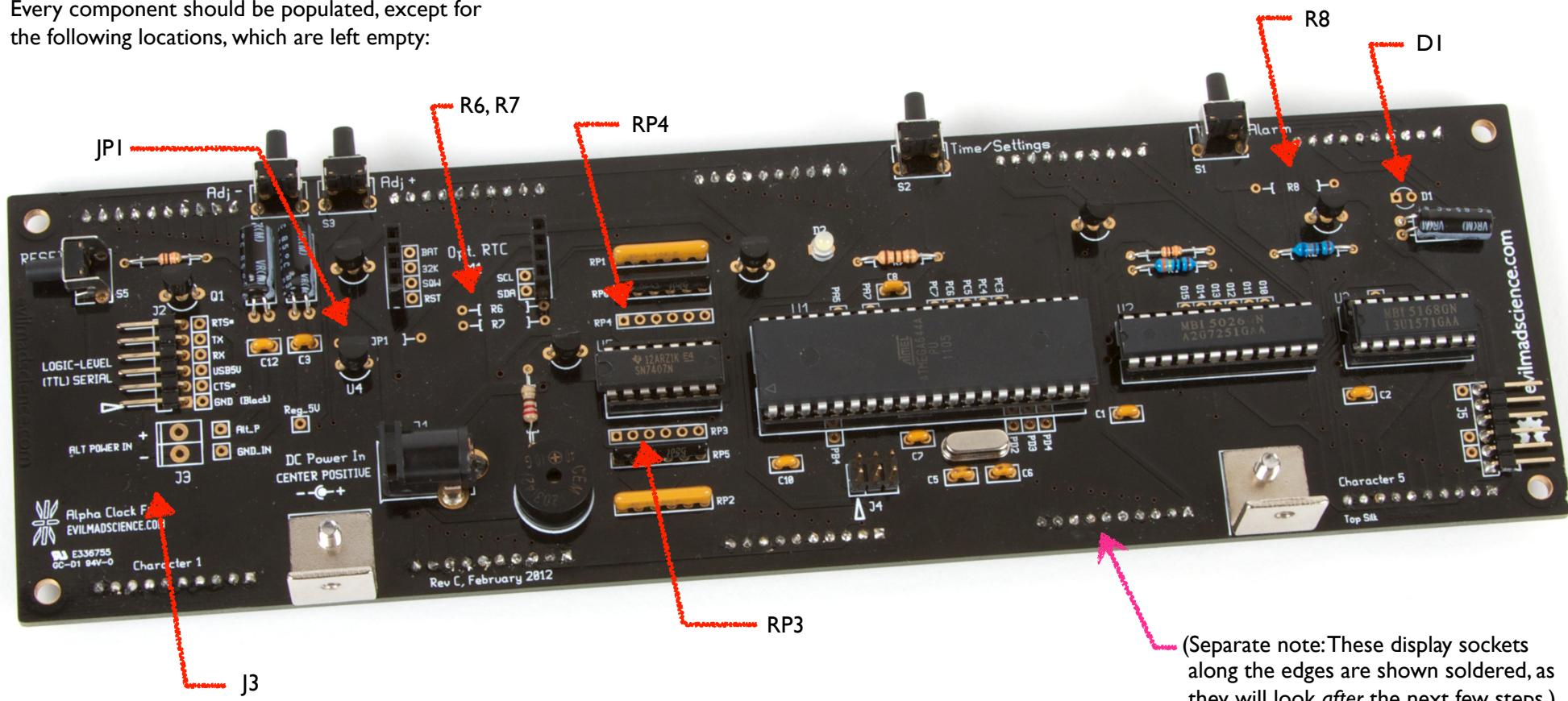
If you are building a **RED** Alpha Clock Five,
skip ahead to the next page, Step 30.

For **BLUE** or **WHITE** Alpha Clock Five:

In the next few steps, we'll be adding the five alphanumeric LED displays, which will make it harder to access the back side of the circuit board. So, this is a great time to make sure that everything looks good so far!

Your circuit board should look approximately like this.

Every component should be populated, except for the following locations, which are left empty:



Assembly Step 30 – Check pins of alphanumeric displays



Red LED Displays

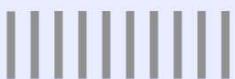
Parts #32 are the five alphanumeric LED displays, in red, white, or blue. The display segments are filled with a diffusing plastic, which may be tinted (for red LED displays) or yellowish (for white LED displays). From this point forward, the instructions are the same.



White LED Displays

Each display has two rows of ten pins each on the back side. Check these pins carefully, to make sure that they are straight, vertical, and parallel, on each display.

If necessary, gently bend them into place.



Good!



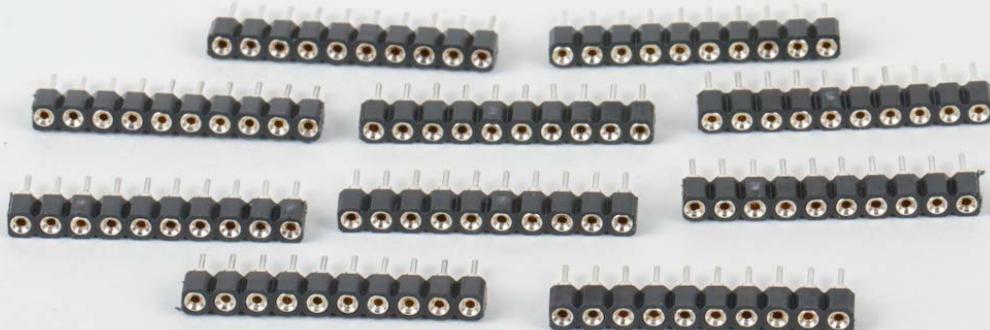
Bad!



Also bad!



Assembly Step 31 – Alpha Sockets



Parts #31 are the 10-position machine-pin socket strips that hold the alphanumeric LED displays. There are ten socket strips in the kit.



Slide one of the 10-position sockets onto the ten pins on one side of an LED display. Make sure that it seats *all the way down*, as shown previously.

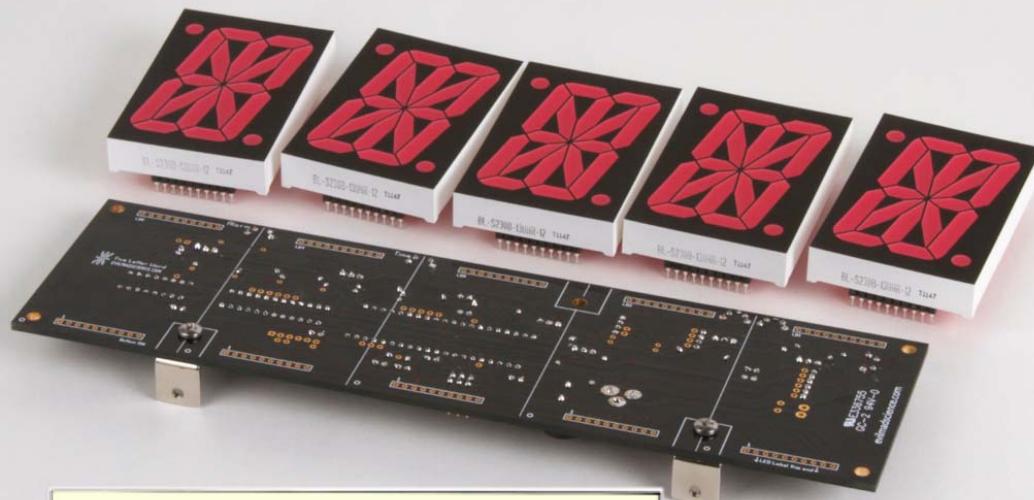
The socket strips press onto the pins of the alphanumeric LED displays, with gentle pressure.

For reference, the socket strips should slide very far down onto the pins-- as far down as shown here:



Repeat for both strips of each LED display.

Assembly Step 32 – Test fit displays

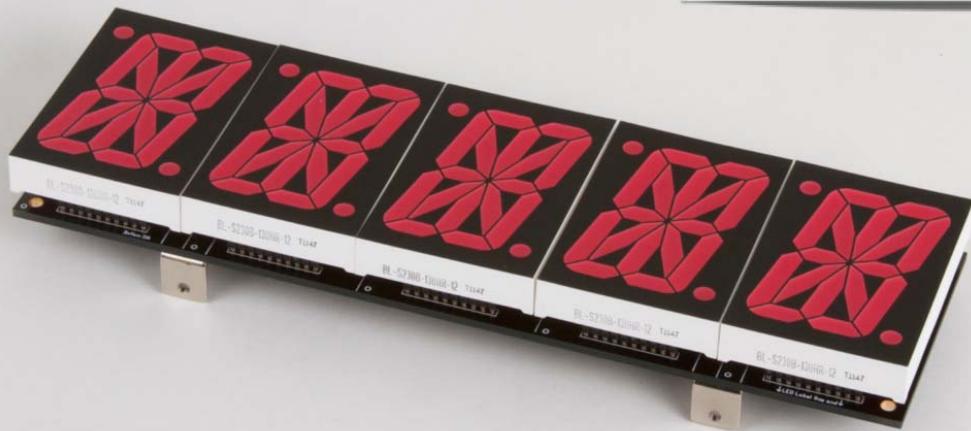


The socketed LED displays will go in locations LD1-LD5, on the back side of the circuit board.



Note that the LED labels should be oriented as shown, towards the side with the angle brackets.

With all of the LED displays sitting in place, check that the front faces are reasonably level, and that the gaps between the displays are relatively uniform.



If the displays do not sit neatly, go back and make sure that
(1) The LED pins are straight and vertical (Step 28) and
(2) The sockets are fully seated (Step 29).

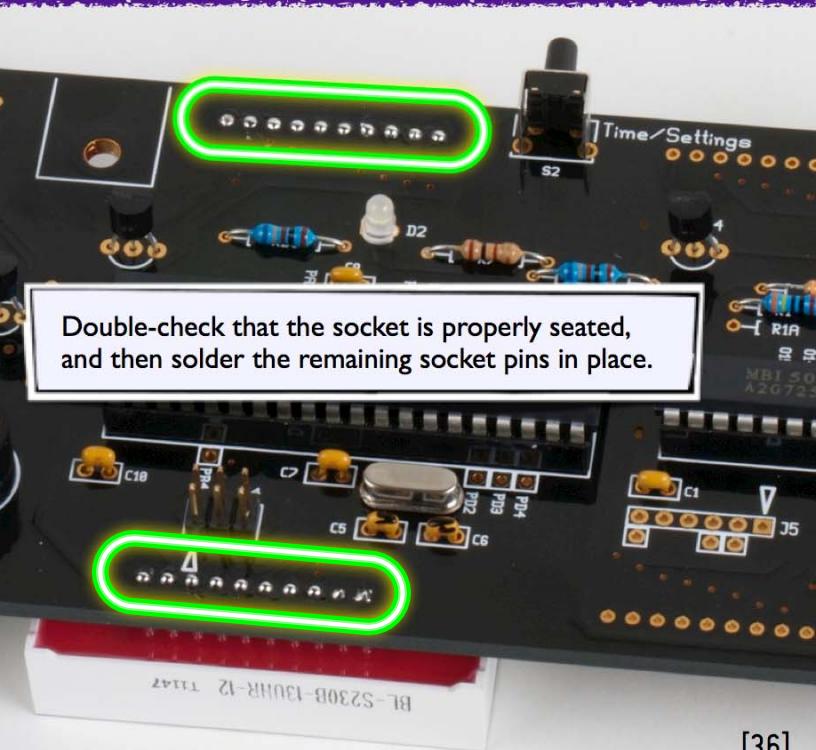
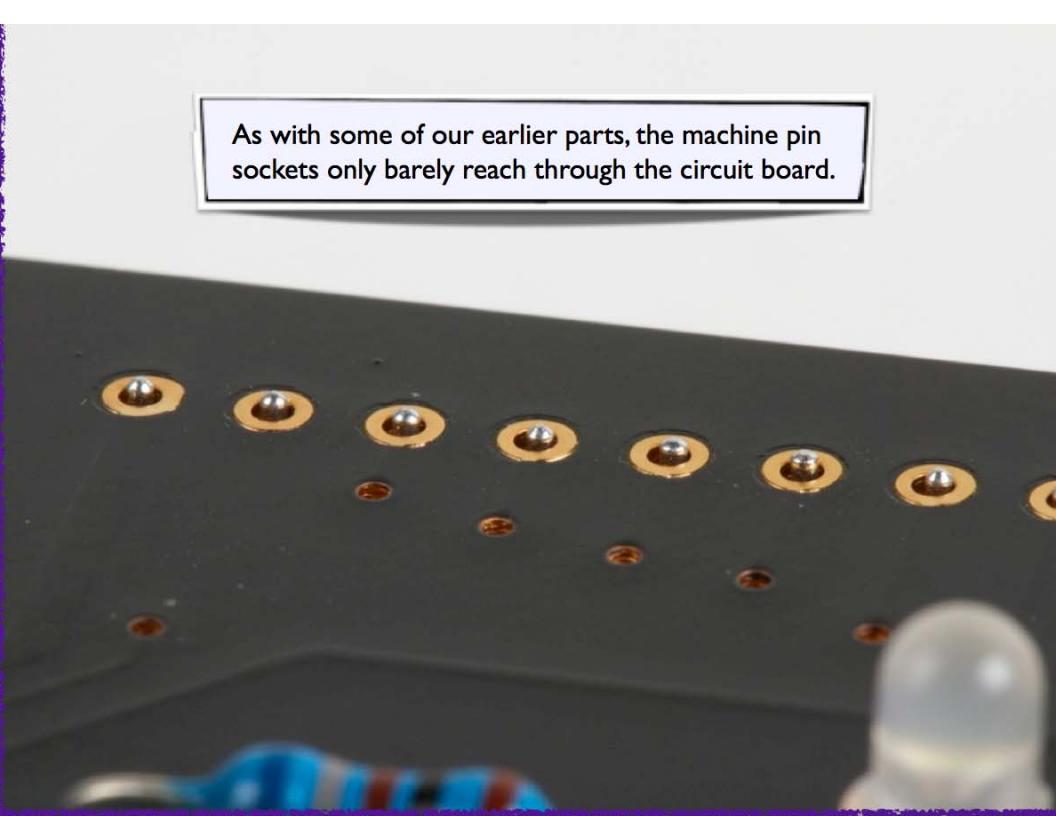
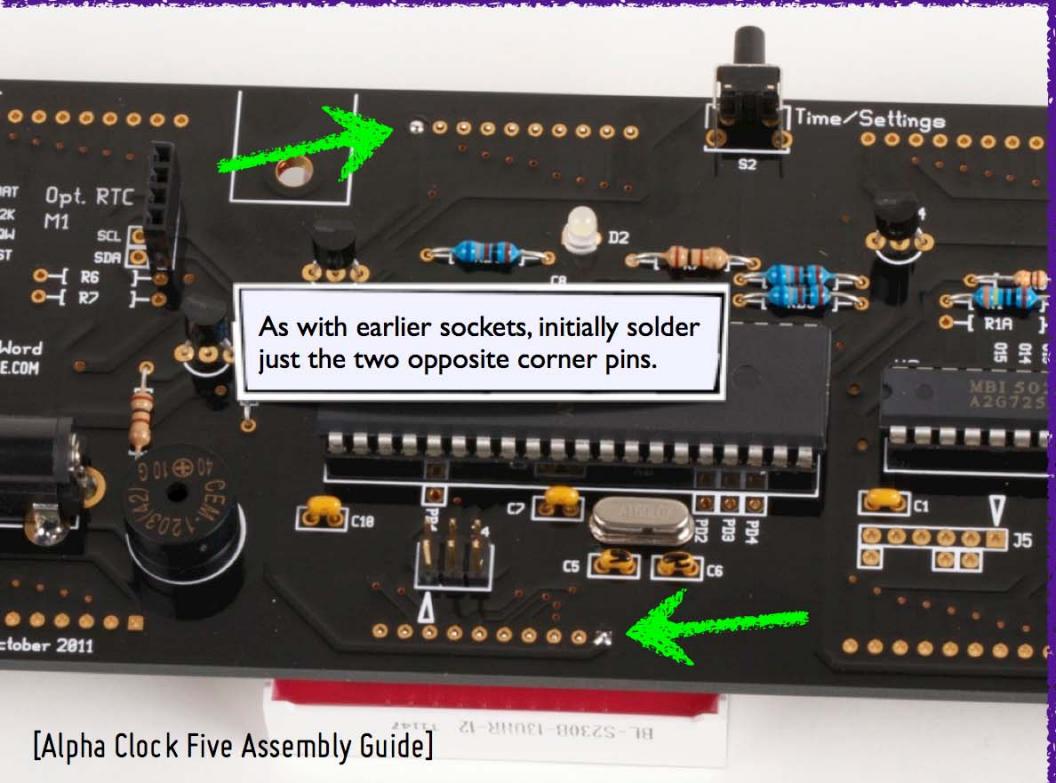
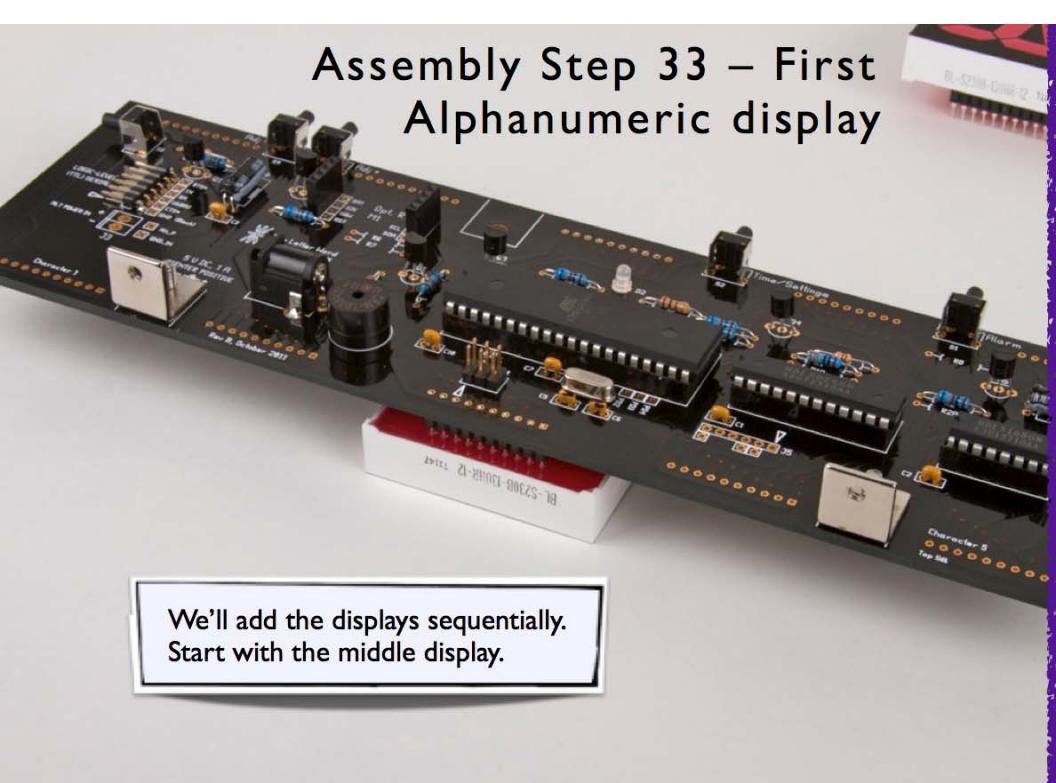
Assembly Step 33 – First Alphanumeric display

As with some of our earlier parts, the machine pin sockets only barely reach through the circuit board.

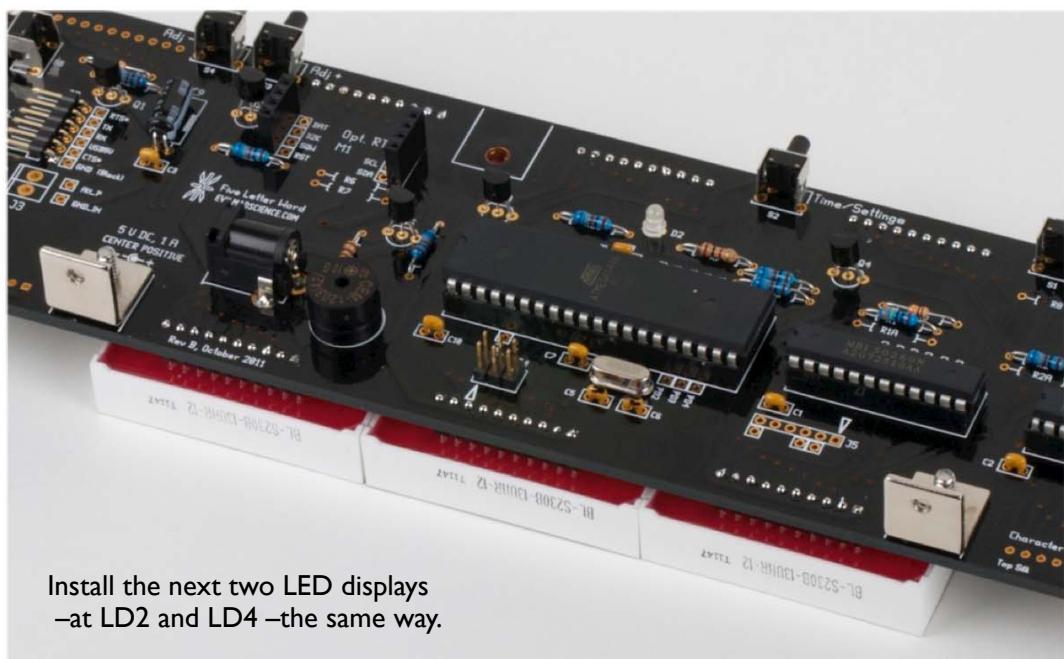
We'll add the displays sequentially.
Start with the middle display.

As with earlier sockets, initially solder just the two opposite corner pins.

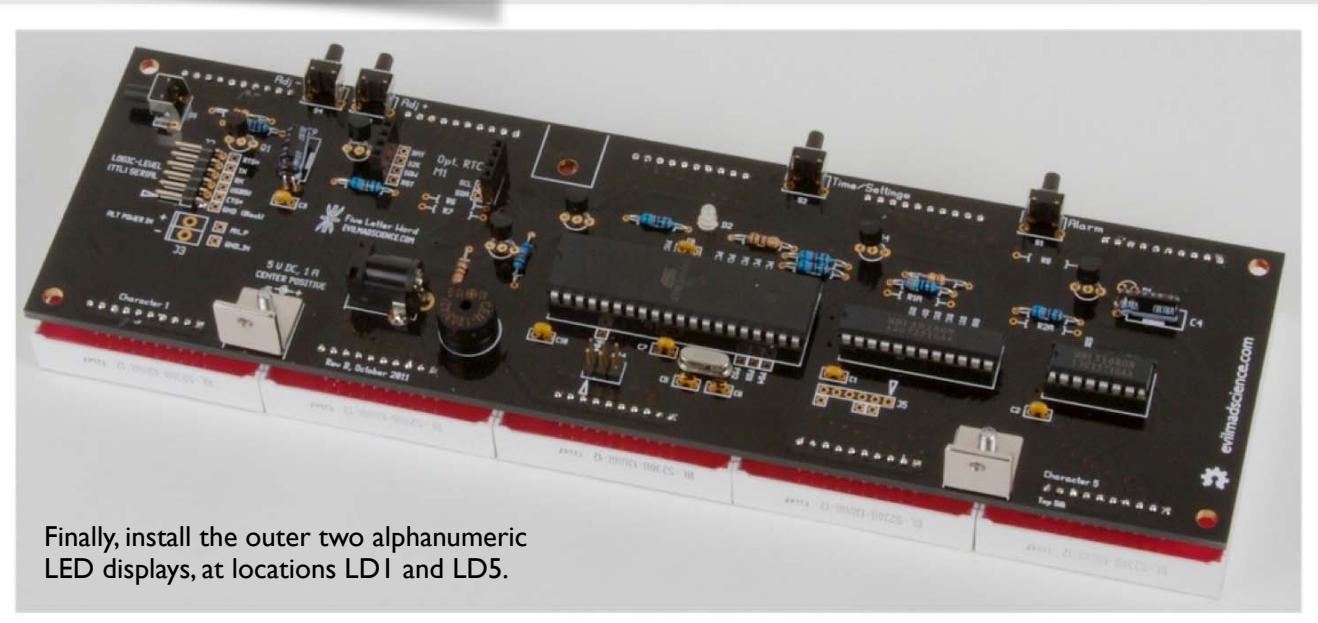
Double-check that the socket is properly seated, and then solder the remaining socket pins in place.



Assembly Step 34 – Add remaining alphanumeric displays



Install the next two LED displays
–at LD2 and LD4 –the same way.

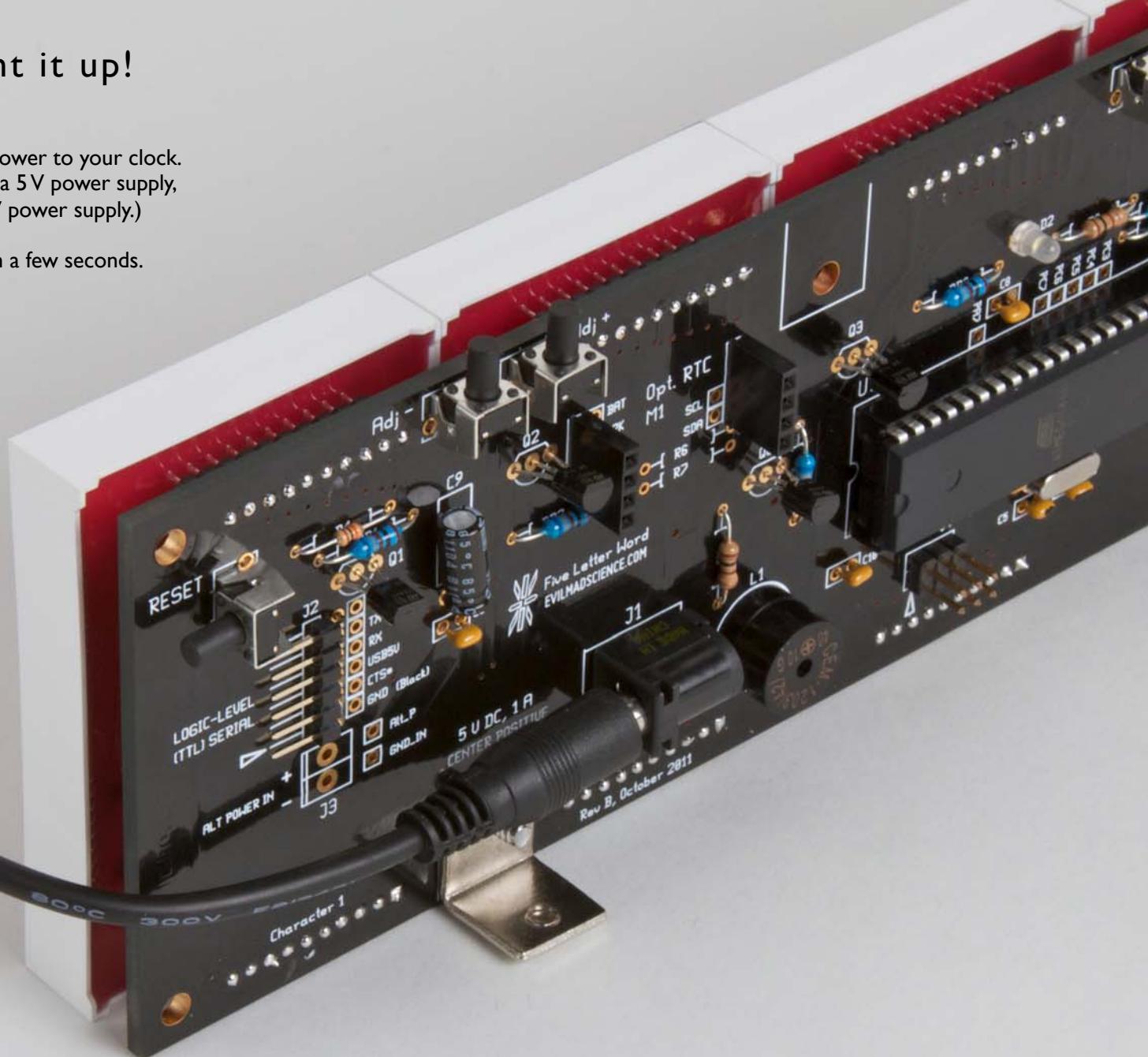


Finally, install the outer two alphanumeric
LED displays, at locations LD1 and LD5.

Assembly Step 35 – Light it up!

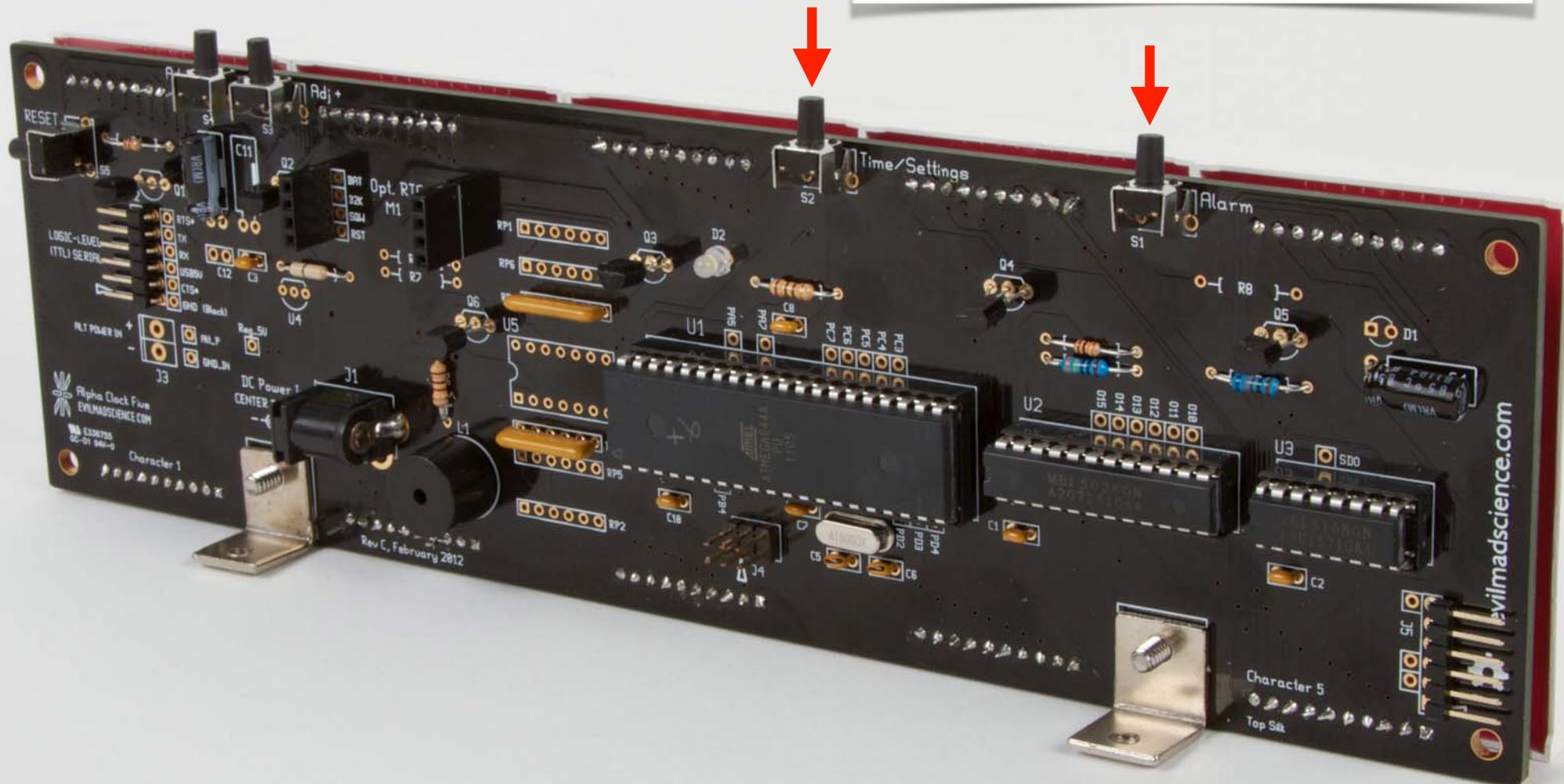
Connect the power supply (#33) and apply power to your clock.
(Red versions of Alpha Clock Five come with a 5V power supply,
whereas blue/white versions come with a 9V power supply.)

If all goes well, it will say “HELLO WORLD” in a few seconds.

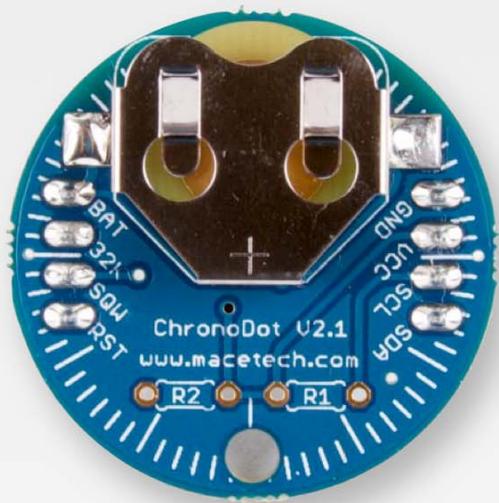


Assembly Step 34 – LED test mode

With the power supply plugged in, hold down both the “Time” and “Alarm” buttons for 4 seconds to enter the LED Test mode. This will generate a slowly changing LED test pattern that will light up every LED on the front face, to help highlight any assembly issues.



Assembly Step 35 – The Chronodot



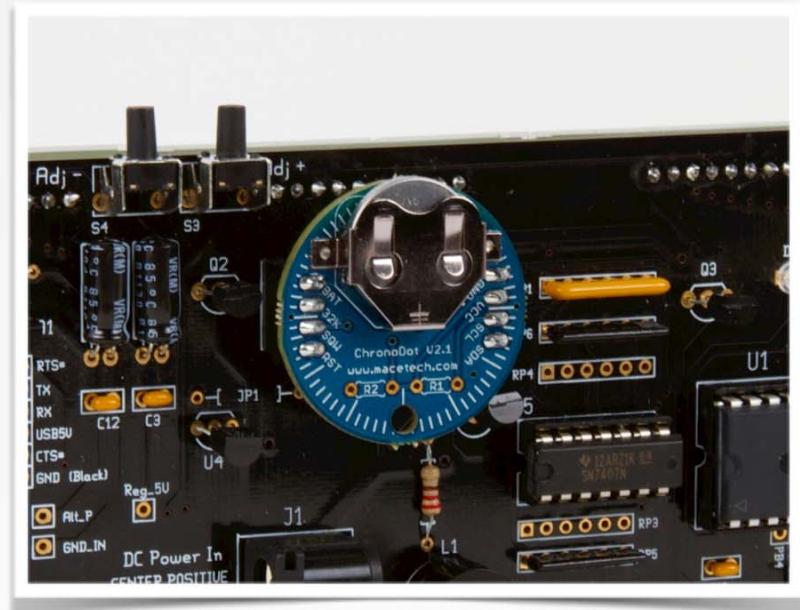
Chronodot
RTC module

The Chronodot is a “real-time clock” (RTC) module with precision quartz timing and battery backup.

Slide the battery into the battery holder on the Chronodot, noting the polarity: “+” side on the battery towards the “+” side on the holder.

Install the Chronodot in the headers at location M1 on the circuit board, labeled “Opt. RTC.” Make sure that all eight pins line up correctly into the sockets, and that the text on the Chronodot is right-side up (i.e., oriented the same way as the text on the Alpha Clock Five circuit board).

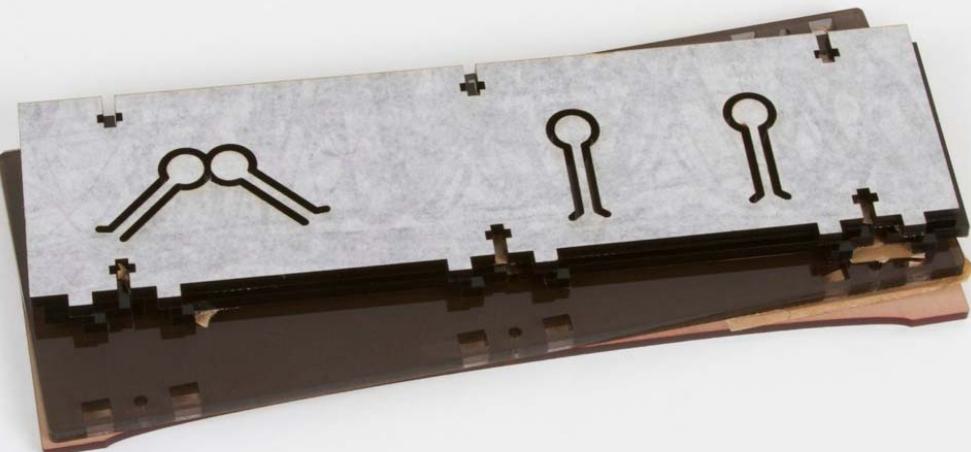
If you have an older (pre-2.0) version of the Chronodot, where the battery and/or headers need to be soldered in place, please contact Evil Mad Scientist Laboratories for soldering instructions.



Important note: Do not set the battery on any conductive surface, or it will drain in a matter of minutes. (Examples: Black conductive foam, silver anti-static bags, steel countertop, etc.)

Similarly, once the battery is installed on the module, do not set the module on a conductive surface.

Assembly Step 38 – Clock Case Parts



The four acrylic case pieces may be wrapped in protective paper or plastic. Carefully peel off this wrapping material.

Next, we'll assemble the acrylic clock case. The case consists of four laser-cut acrylic pieces.

Acrylic is brittle and can break if overstressed. Accordingly, please take care in the following steps not to over-tighten the fasteners that hold the case together.

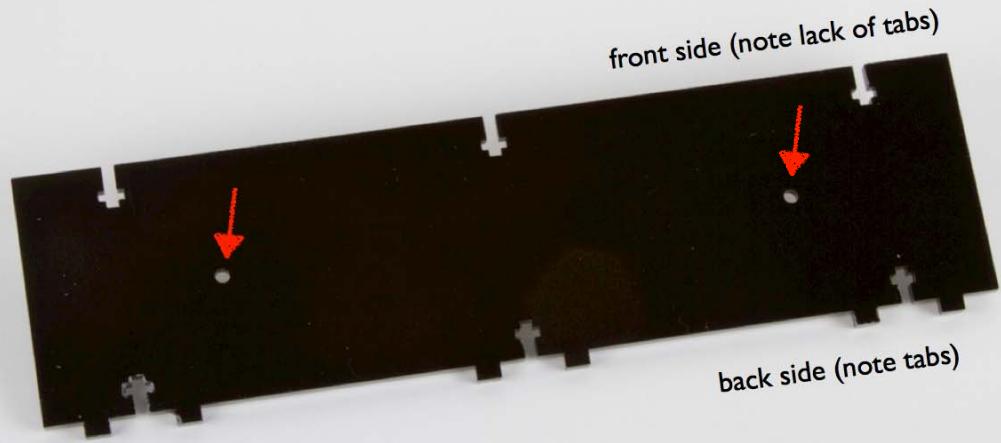


The front is either smoke gray or tinted, depending on the color of your Alpha Clock Five.

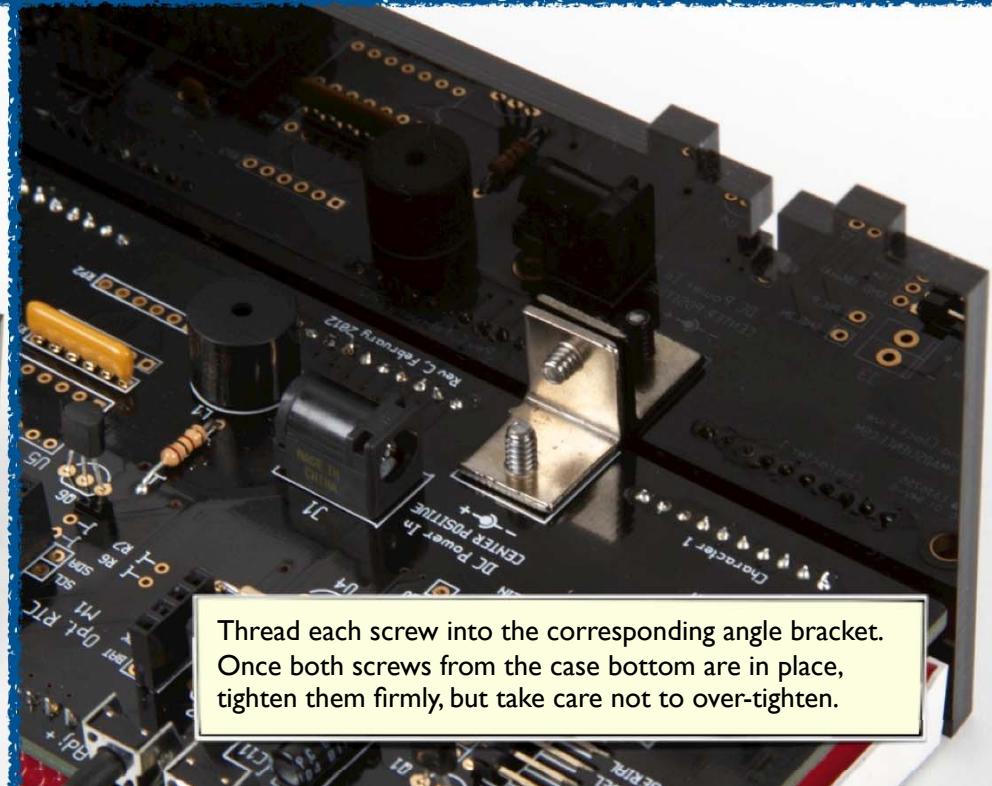
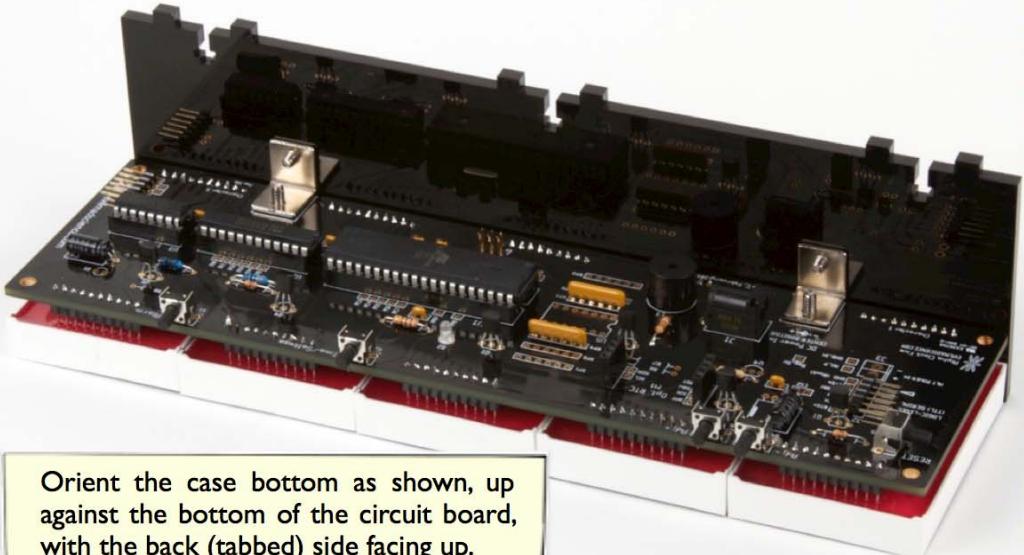
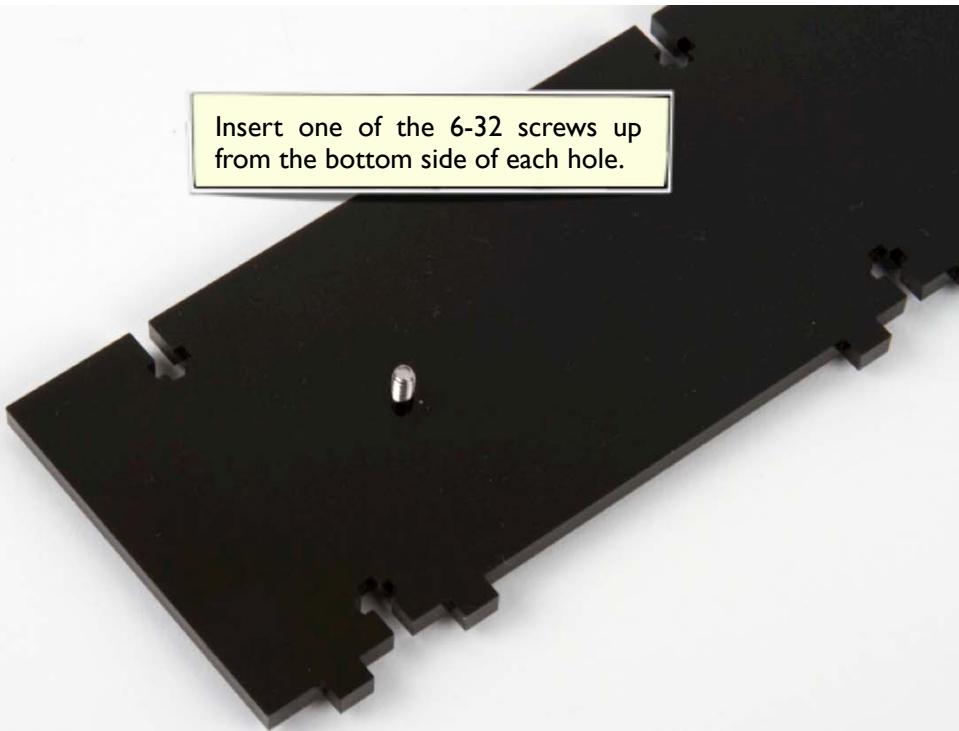
Black screws
(4-40) #40



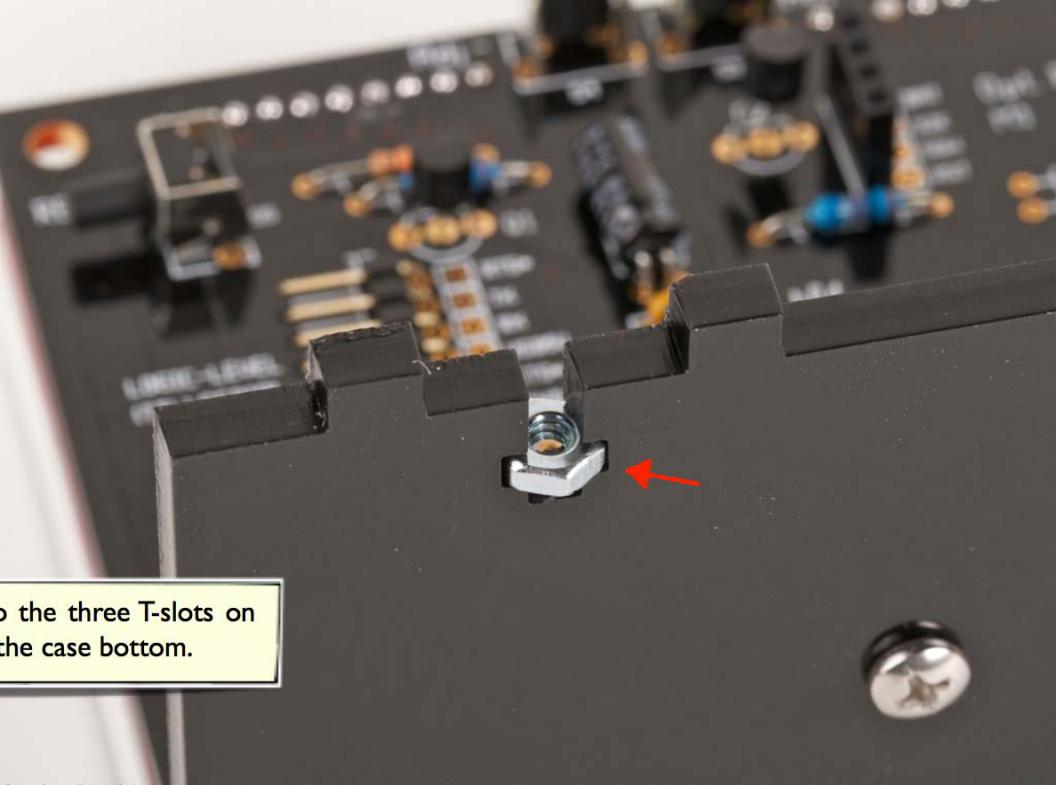
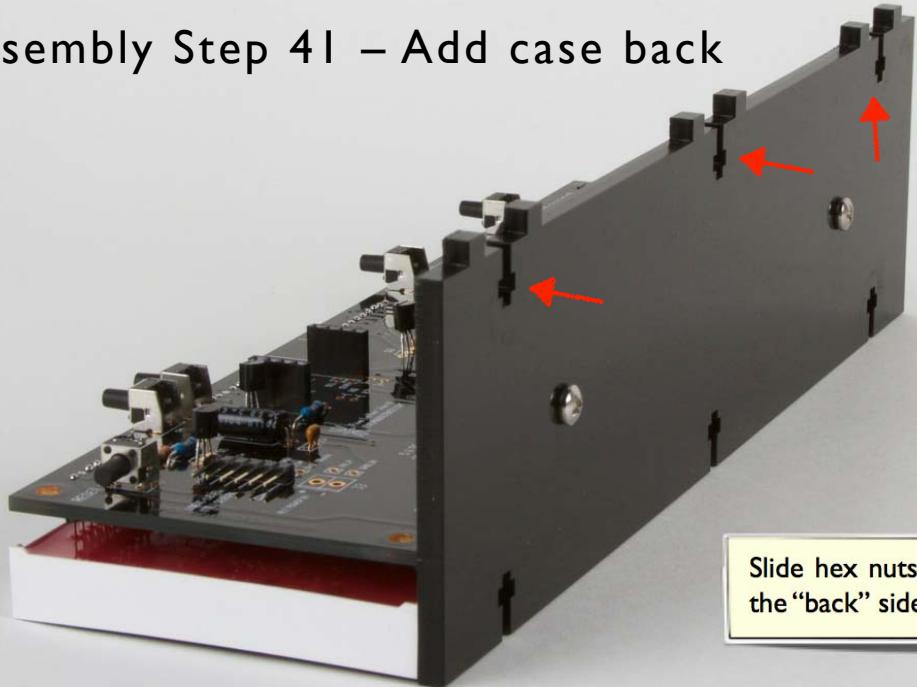
Assembly Step 39 – Begin Case Bottom



Begin with the case bottom, oriented like so.
There are two through-holes in the case bottom.

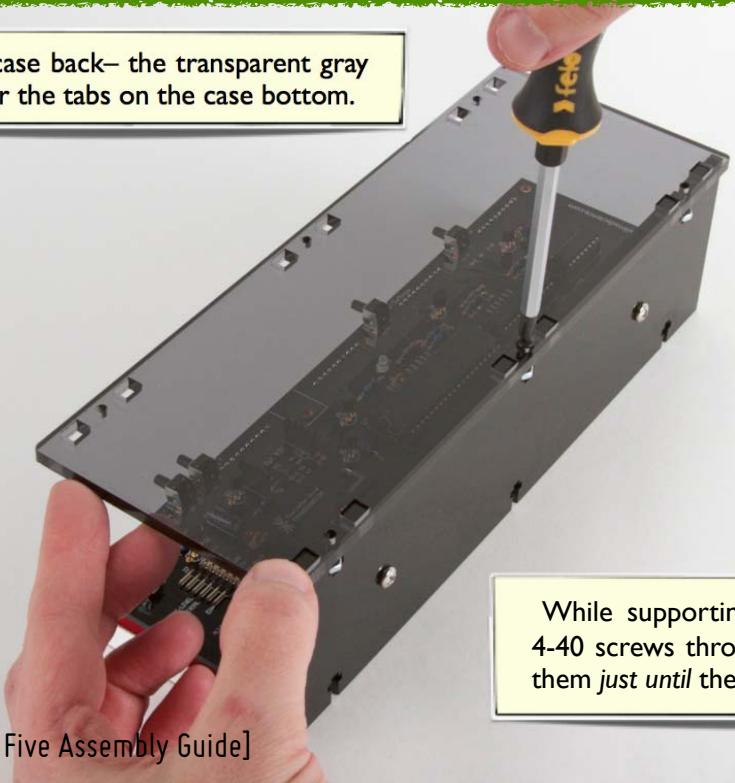


Assembly Step 41 – Add case back



Slide hex nuts into the three T-slots on the “back” side of the case bottom.

Place the case back– the transparent gray piece –over the tabs on the case bottom.

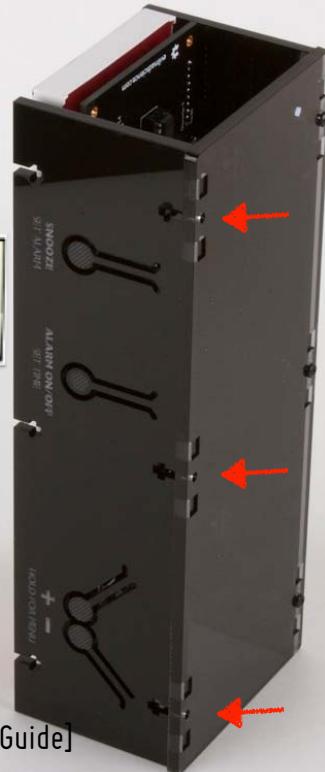


While supporting its weight, insert three of the black 4-40 screws through the top and into the nuts. Tighten them just until they support the weight of the case back.

Assembly Step 42 – Add case top

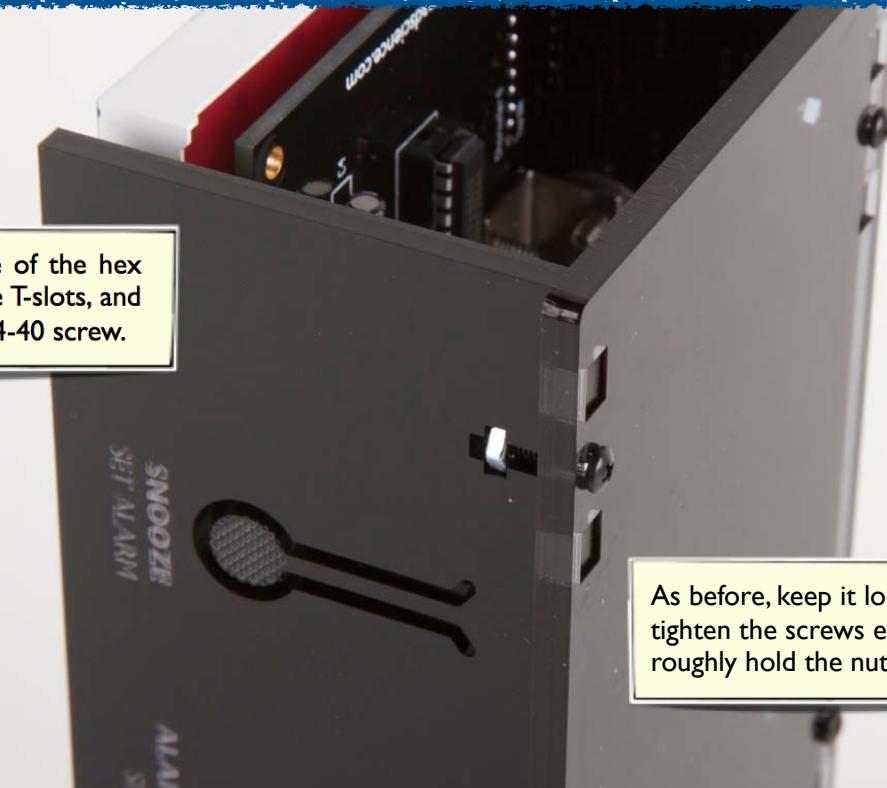


Here's what we've got thus far: the case bottom and back sides are attached.



Stand the case up on end, and slide the top into place.

One at a time, insert one of the hex nuts into one of the three T-slots, and fix it in place with a black 4-40 screw.



As before, keep it loose: Only tighten the screws enough to roughly hold the nuts in place.

Assembly Step 43 – Add case front



Add three hex nuts to the T-slots along the front-bottom of the clock.



Position the case front in place, with the curved, footed side towards the bottom of the clock.

Insert three more screws through the front plastic, to engage the hex nuts.

Hold the hex nuts flush against the LED displays while you tighten the screws.

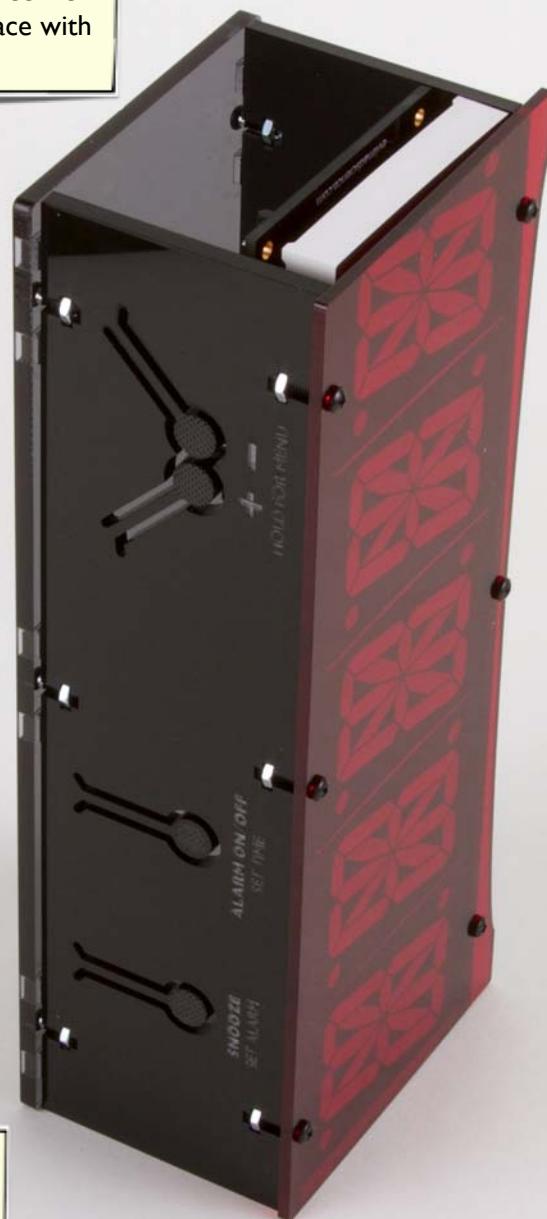
And, on this side, tighten the three screws firmly.



Assembly Step 44 – Final screws



One at a time, add the final three hex nuts and screw each one into place with one of the black 4-40 screws.

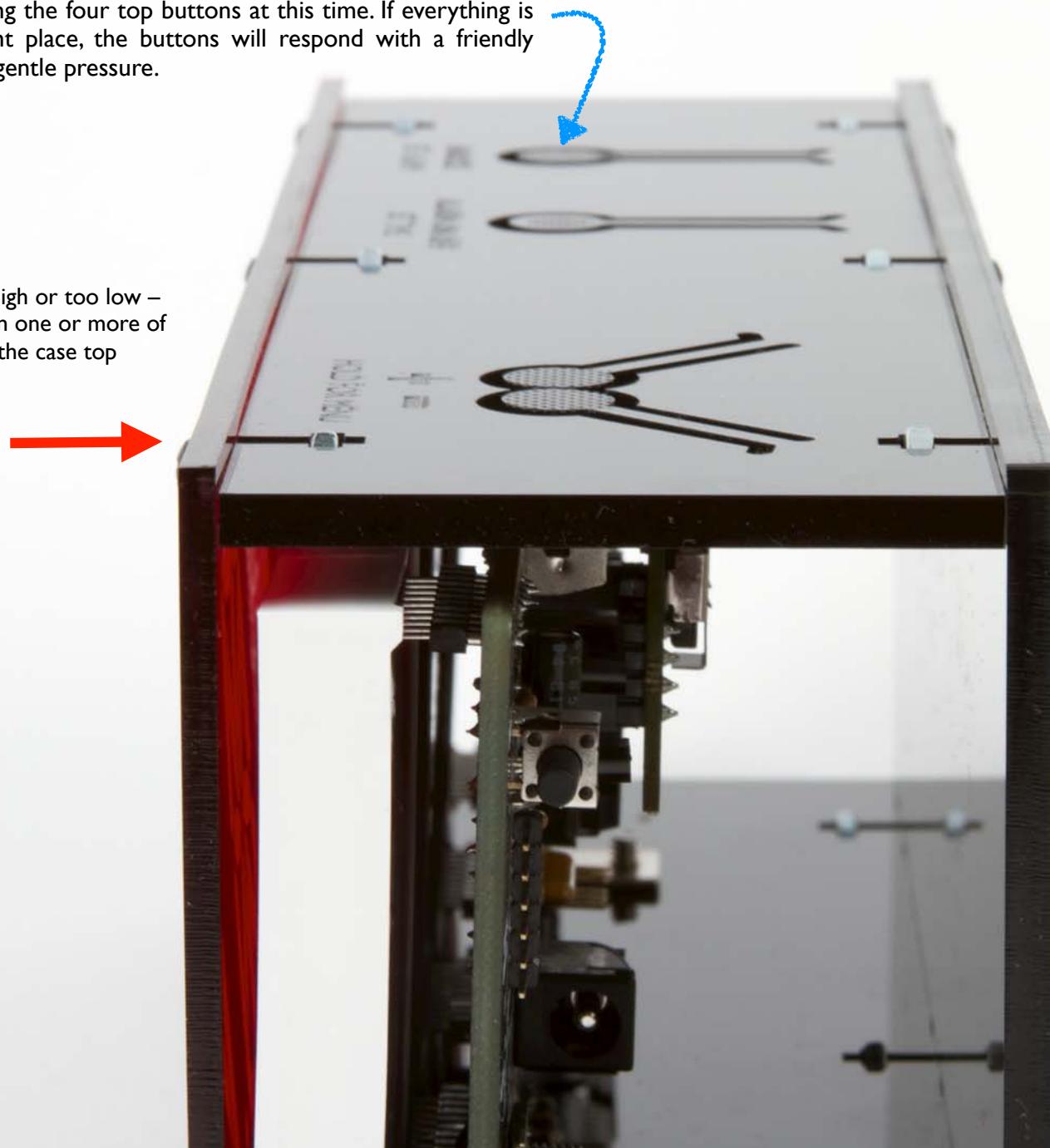


If you have trouble getting the case front to reach the case top, the screws on the back side are probably too tight; try loosening them a bit.

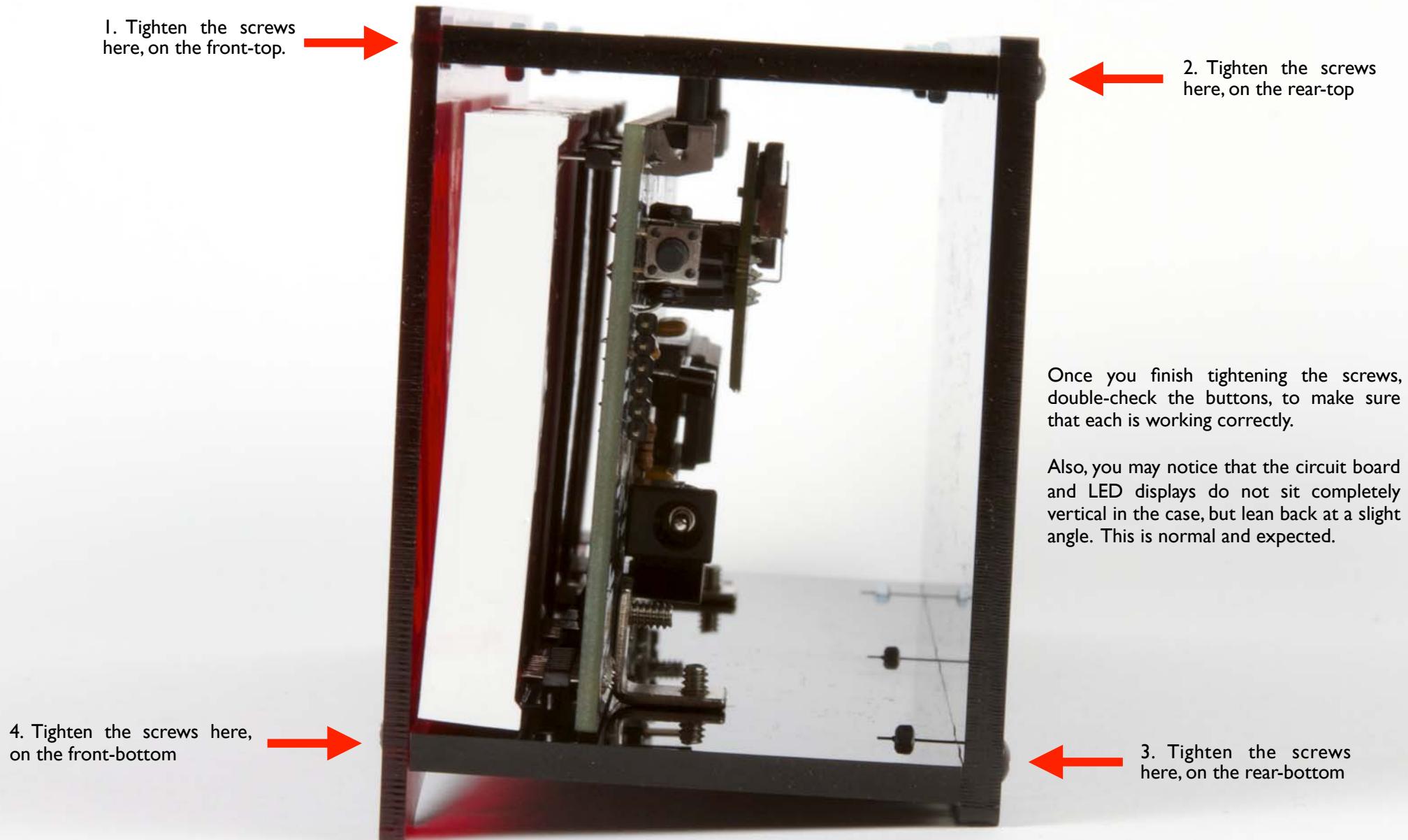
Assembly Step 45 – Check button function

Try pressing the four top buttons at this time. If everything is in the right place, the buttons will respond with a friendly “click” to gentle pressure.

If not– if the top piece is too high or too low – you may need to slightly loosen one or more of the front-top screws to move the case top where it needs to go.



Assembly Step 46 – Tighten screws all around





This completes the assembly of Alpha Clock Five.

Please see the User Interface Guide (on the following page) to learn how to operate your clock.

Please visit our wiki site, <https://wiki.evilmadscientist.com/alpha> for much more additional documentation

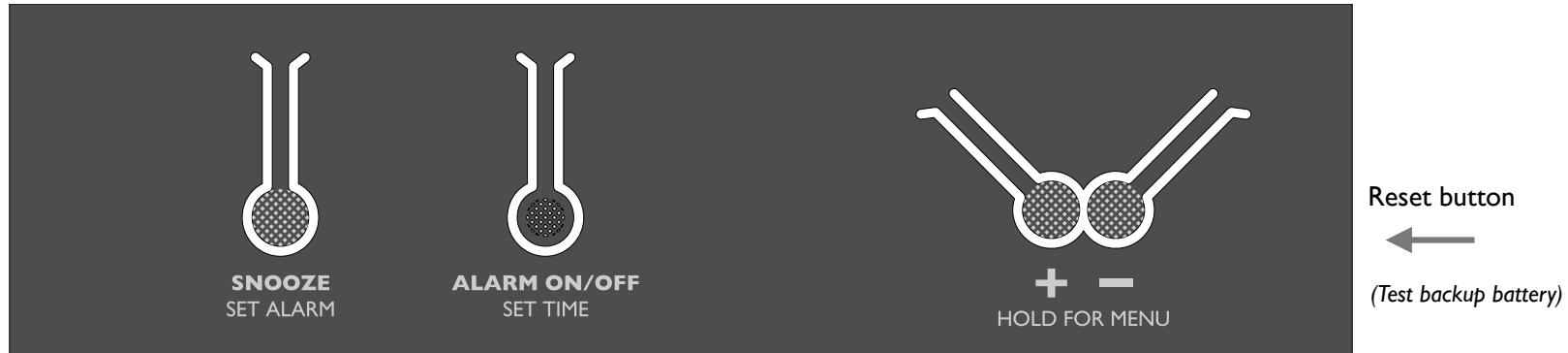
For technical support, please visit our Clock support forum,
<http://www.evilmadscientist.com/forum/>

Alpha Clock Five

– Firmware v. 2.0 –

User Interface Guide

Page 1 of 2:
Main Button Usage



	SNOOZE SET ALARM	ALARM ON/OFF SET TIME		+	-
Press	Snooze	Alarm: On/Off		Brightness: Increase	Brightness: Decrease
Press	Simultaneous press: Show date			-	
Hold	Show alarm time Adjust alarm time, using +/-	Adjust time, using +/–		-	-
Hold pair	Simultaneous press and hold (4 seconds): Show firmware version & Enter (or leave) LED test mode			Simultaneous press and hold (2 seconds): Enter (or leave) settings menu	

Alpha Clock Five

– Firmware v. 2.0 –

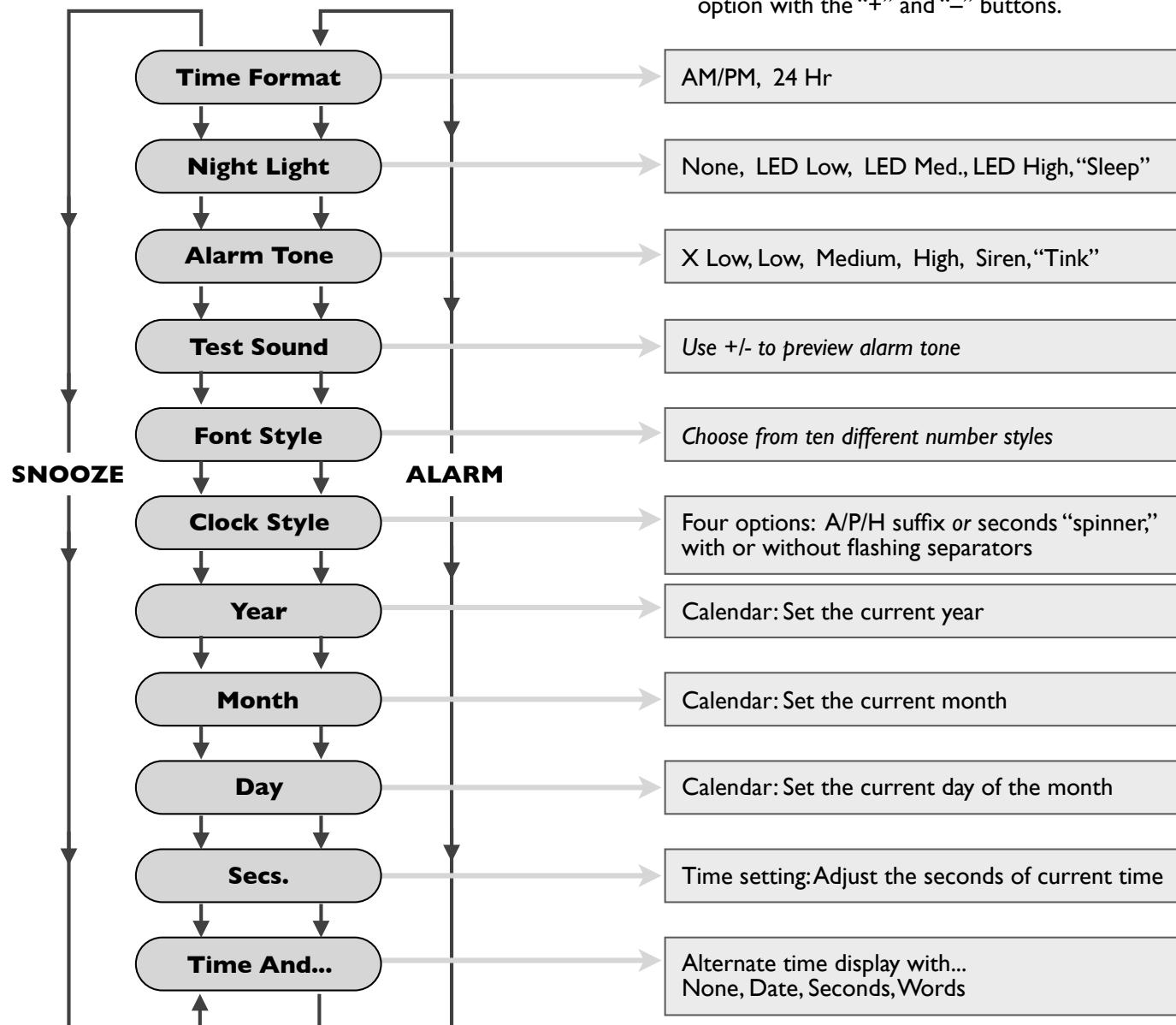
User Interface Guide

Page 2 of 2: Settings Menu Guide

To enter or exit the settings menu:
Press and hold both "+" and "-"
buttons for several seconds.

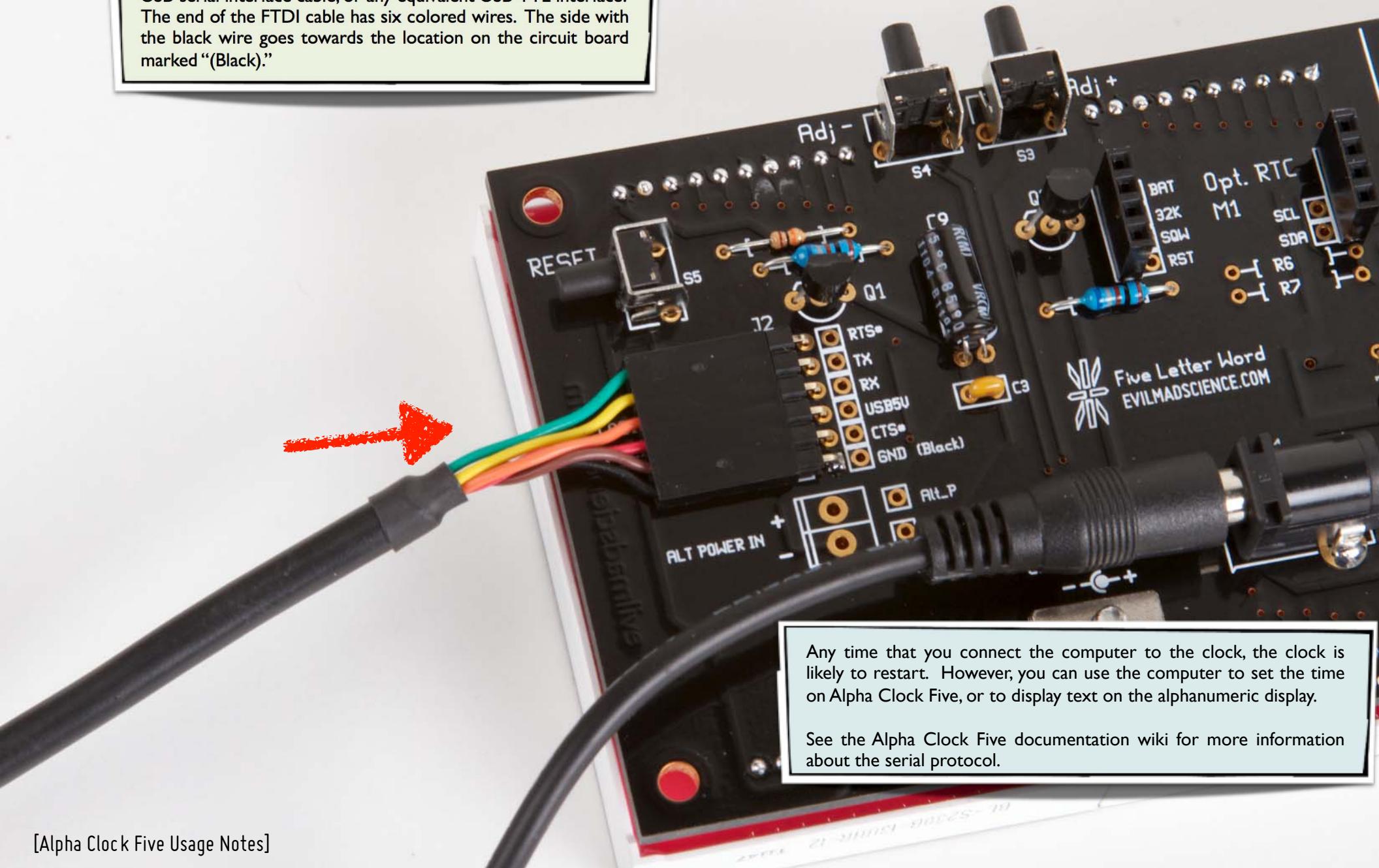
Settings Menu:
Use Snooze and Alarm buttons to
switch between menu options.

Switch between values for each menu
option with the "+" and "-" buttons.



Appendix: Hooking up to a computer

J2 is a 6-pin header for connecting to an FTDI model TTL-232R USB-serial interface cable, or any equivalent USB-TTL interface. The end of the FTDI cable has six colored wires. The side with the black wire goes towards the location on the circuit board marked "(Black)."



Any time that you connect the computer to the clock, the clock is likely to restart. However, you can use the computer to set the time on Alpha Clock Five, or to display text on the alphanumeric display.

See the Alpha Clock Five documentation wiki for more information about the serial protocol.