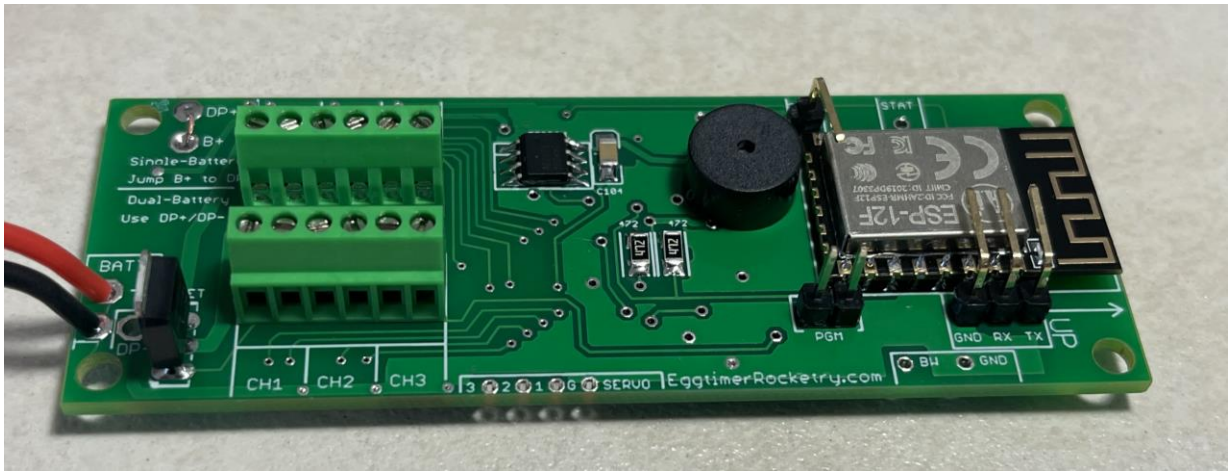
Eggtimer Proton
WiFi-Enabled Flight Computer
Assembly Manual

Rev C14



California Proposition 65 Warning

WARNING: This product contains chemicals (lead) known to the State of California to cause cancer and birth defects or reproductive harm.

This kit includes a special low-temperature ultra-fine leaded solder wire, Kester 245 p/n 24-6337-8807. Including the solder with the kit ensures that you will have solder that can be used to easily mount the surface-mount parts in the kit. Leaded solders have been used for over a century in electronic assembly, but you should take the following precautions when using it (or just about any chemical, for that matter):

- Do not eat or drink while using it
- Wash your hands after handling it
- Keep it in the protective bag when you're not using it

The SDS can be found at:

https://www.kester.com/downloads?EntryId=958&Command=Core_Download

Important Regulatory Information

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

It is intended to be used ONLY for educational and experimental use in Class II/III amateur High Power Rockets which are classified as aircraft by the Federal Aircraft Administration (CFR 14 §101.25), and which must by FAA and NFPA regulations be operated at least 1,500' away from any populated buildings. Although unlikely, this device may cause interference with consumer devices that run on the unlicensed 2.4 GHz band, and therefore must not be used in residential areas.

Contains FCC ID: 2AHMR-ESP12F

The Eggtimer Proton uses an ESP8266-12 801.11n WiFi module in the 2.4 GHz unlicensed band, per FCC part 15. It is intended to be used only in the United States or other countries in which this band (or a subset of it) is not subject to licensing. We have made a good faith attempt to comply with all technical regulations, and you should too by building it **exactly** as per the instructions, and by not modifying the WiFi module in any way.

Because the Proton runs on an unlicensed band, there is no protection against interference from other sources; basically, you get what you get. We've done substantial testing and are confident that your Proton is unlikely to be significantly affected by outside radio sources, but there's no guarantee.

If your Eggtimer Proton causes interference in a residential setting, or with licensed radio systems (such as TV or ham radio), you **must** stop using it until you correct the problem. This is extremely unlikely given the small amount of power, and in particular the distance from any population that HPR rockets must be flown. Nevertheless, you need to be aware of this, and be willing to abide by the rules. These are the same rules that govern other non-licensed transmitters, such as cell phones, WiFi and Bluetooth® devices, and garage door openers.

Important Regulatory Links:

FCC Part 15 (governing unlicensed intentional and unintentional emitters):
https://www.ecfr.gov/current/title-47/chapter-I/subchapter-A/part-15

FAA Regulations for Amateur Rocketry (Part 101):
https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-101

Before You Start…

• Go to our web site at www.EggtimerRocketry.com and download the latest Assembly/Users Guide..

• Read them thoroughly before starting… it will save you some grief later, we promise!

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Thanks for buying an Eggtimer Proton! The Proton integrates a 6-output flight computer and 200G accelerometer with a WiFi access point and server, so you can program, arm/disarm, test, and download all from your handheld device. It uses a simple browser interface, so it will work with virtually any wireless device, no apps or other special software required. You can monitor the battery status and the continuity of your deployment channels, all from over 100' away typically. Each Proton has a unique WiFi SSID code, and it uses the WPA2-PSK connection protocol with a unique 8-digit passkey, so it's almost impossible for anyone except yourself to connect to your Proton and turn it on (or off!). To arm your Proton you need to enter a 4-digit validation code that changes every 60 seconds or whenever you refresh the web page. It also needs to be pointing "up", i.e. your rocket needs to be on the rail first. This prevents it from being accidentally armed or disarmed… you wouldn't want to "pocket dial" your altimeter!

After your flight, you can view summary flight data right on your handheld device, and you can also download a csv-formatted detail file to your device for analysis using a spreadsheet or other program. It holds your last 14 flights, and numbers each one so you know which one is which.

Finally, you can also perform a full-blown deployment test, from over 100' away, without having to worry about several grams of BP going off in your face.

Like other Eggtimer Rocketry products, we sell it as a kit, to keep costs down and provide an outstanding value. This means that you have to do a little work, of course, but considering that most hobby rocketeers that would use our products have some degree of electronics expertise; this should not be much of an impediment. If you do not have any experience soldering kits such as this, we recommend that you ask around… chances are that somebody in your rocketry club would be more than happy to assist you for a small bribe (beverages work well!).

About Soldering Your Proton…

Assembling your Proton kit isn't that hard, but we recommend that you don't choose it as your first kit project. You must be able to solder small components using fine solder and get nice shiny solder joints. If you have never soldered before, you need to learn anyway, because if you are going to do rocketry electronics you're going to be doing some soldering. If you want to get into advanced projects like telemetry, you're probably going to be doing a lot of soldering. We recommend that you get a few small kits from Ramsey or SparkFun, put them together, and hone your skills on them first. There's a lot of fun stuff out there, so go for it!
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The Proton uses a number of Surface Mount Technology (SMT) parts, they are large by SMT standards, and are well within the realm of being hand-solderable. In order to help make your assembly successful, we have included some very fine (.020"), very low temperature (about 180°C), no-residue solder. This is not the stuff that you get at Radio Shack… it's designed for soldering small temperature-sensitive parts without transferring much heat to the part itself.

Important Note on using flux: Be VERY careful about your choice of any extra flux. You really don't need to use any, but if you do choose to do so make sure that you use a liquid "no-clean" type of flux such as Kester 951. DO NOT use any kind of rosin or similar organic flux, it is almost certainly going to be incompatible with the flux in the no-clean solder and make a big mess. Extra flux may require excessive heat in order to boil off the flux, possibly damaging the sensitive components in the kit.

For soldering components on a board like the Proton, we recommend a small pencil soldering iron, about 15W. If you are only going to use it occasionally, Weller makes a decent cheap 12W iron, it's about $15. There is also a similar iron that's sold by ECG. We like those, but the copper tips seem to oxidize and corrode rather quickly compared to some more expensive irons; fortunately, the tips are replaceable and cheap. Better would be a fancier soldering pencil with iron tips; those run about $30, but they'll last forever. The best iron would be a temperature-controlled solder station; they typically start at about $50 for a cheap one and can go to a few hundred dollars if you want to get really fancy. Weller makes a good one for about $50, if you make the investment that will probably be the last soldering iron you will ever need to buy. These solder stations usually have a little well with a tip-cleaning sponge, so they end up taking less room on your workstation too. Get the smallest tip you can find, preferably with a conical tip that's about the same width as the smallest pad. .032" (.8 mm) conical tip is ideal. We do NOT recommend that you use an extremely-fine "needle nose" tip, we have found that they may not conduct enough heat to the pads to allow the solder to flow out well. A conical tip with a 1/32" width (.031") should be fine.

About soldering the SMT resistors and capacitors

A lot of people get put off by the idea of having to solder small SMT parts like resistors and capacitors, but it's really not that hard to do once you get the hang of it. In fact, many of our users prefer SMT parts to through-hole parts, because you don't have to clip the leads and they just plain look cooler. Here's how to mount them… once you do one or two you'll find that it's actually pretty easy.

Lightly tin only ONE of the two pads on the board. With tweezers, lay the part down on the board, and heat up the lead over the tinned pad until the solder flows. Wait a few more seconds, then remove the heat, holding the part there until the solder cools for a few seconds. Let it cool for another 10 seconds, then carefully solder the other pad, being careful not to use too much heat. You don't need a ton of solder, just enough to make sure that the part is bonded to the pad. Once the solder starts to flow, remove the heat and let the joint cool. If you keep the heat on too long, you may heat up the part enough so that both joints melt and the part is likely to lift off the board when you remove your iron. It might also "tombstone", that is, lay on end due to the previously-soldered joint melting. If this happens, just heat up the joint, remove the part with your tweezers, and try again.

After you've soldered the part in place, inspect the joint carefully with a 10x jeweler's loupe. You should see good solder coverage on the pad with the solder wicking up to side/end of the part, and there should not be any solder splatter or bridges. (Splatter means your iron is too hot… turn it down about 50F and try again). If you don't like what you see, heat up the joints and remove the part, and/or clean it up with some solder wick, and start over.

Alternate Method: Using a Hot Air Tool…

If you've done a fair amount of SMT work you may have a hot air rework tool. These are very cool, and they can make SMT soldering a lot easier if you have some experience. You can speed up the assembly a bit if you have some no-clean solder paste and a hot air tool. Just put a very small amount on the pads for each part (it shouldn't be blobbed up… you only need a tiny bit), set the part on the pads, then gently go over the pads with your hot air tool. We recommend about 300C to start with, adjust the temperature up or down depending on your specific paste. Note that we strongly recommend that if you do it this way you use solder paste containing no-clean flux, most of them are that way nowadays, though. We recommend that you do one part at a time, that helps prevent you from accidentally knocking some part off the pads and smearing the solder paste somewhere that you don't want it to be. Note that only about half of the parts are SMT, so you're still going to have to use a soldering iron and the wire for the through-hole parts.

We do NOT recommend that you use a hot air tool to mount the WiFi module. First, it needs to be raised slightly from the board in order to prevent it from shorting out "vias" on the board. The WiFi module isn't going to be laying flat against the board, which pretty much eliminates the idea of using a hot air tool to mount it.. Second, if you get it a little too hot you can damage the WiFi module, and/or loosen the metal RF shield (which is there for FCC compliance), possibly shorting the pads. Just mount it as directed as a through hole part and you'll be fine.

General Assembly Information

We're sure that you are ready to get started, but before you do you will need to get some tools together. The tools that you will need are:

___ Low-wattage soldering iron, 15W or less, with a fine conical tip

___ Small needle-nose pliers

___ Small diagonal cutters

___ Tweezers to handle the SMT parts (bent-nose tweezers work the best)

___ A small damp sponge for cleaning the tip of your soldering iron
(mesh "sponge" works great too)

___ A sal ammoniac block or "tip cleaner" (not essential, but helpful)

___ A lighted magnifier, for inspecting solder joints (not essential, but very helpful)

___ A jeweler's loupe or small 10x magnifier, for inspecting the SMT solder joints
(again, not essential but VERY helpful)

___ A small hobby vise or PC board holder (not required, but nice to have)

___ A well-lighted place to work, preferably with a wood or metal surface,
also preferably not carpeted

___ Some PAPER masking tape (do NOT use Scotch® tape or electrical tape)

___ A few round wooden toothpicks

Each installation step has a check-off line, we strongly recommend that you check them off as you go, and that you perform the steps in sequence. We have listed the steps in order to make it easiest to assemble the Proton, deviating from them isn't going to make your life any easier.

Each step is pictured, so you can see exactly what you need to be soldering. Looking at the pictures as you go will help prevent you from soldering the wrong thing, or putting something in the wrong way.

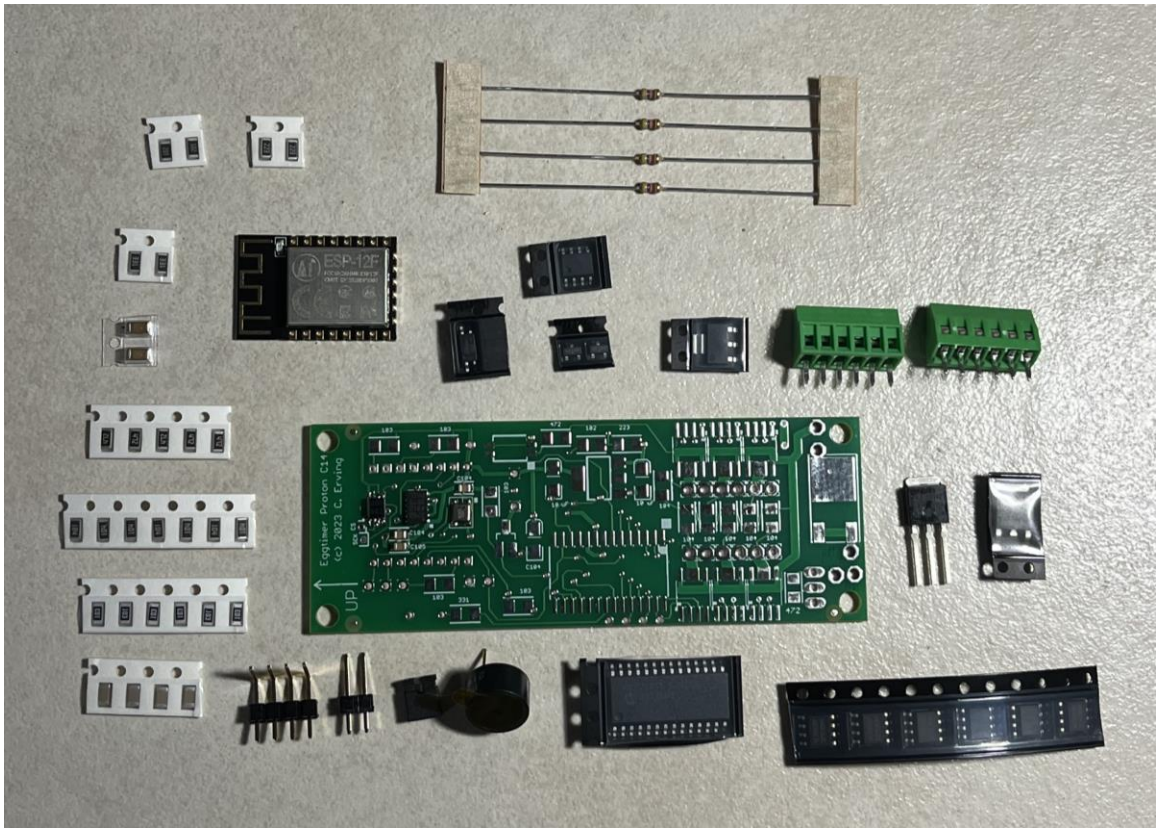
If you have any questions about soldering a part, STOP and send us an email, support@eggtimerrocketry.com We generally get back to support requests the same or next day… especially if you tell us that your launch is "really soon".

Assembling your Proton

Sort the Components

Before you start soldering anything, you need to lay everything out and make sure that you are familiar with all of components, and that you have everything. If you are missing something, let us know immediately so we can send you whatever you need. You should have the following parts, check them off as you sort them. Note that some of the smaller parts may have extras… you don't want to have to stop just because you drop some teeny little part. Also note that there may be one or two parts that you don't have depending on your board revision; check the revision on the board before you decide that you're missing something.

	Qty	Description
__	1	Circuit board with pre-mounted sensor components
__	1	Pre-programmed ESP8266-12 WiFi Module
__	1	CAT24M01 128Kx8 I2C EEPROM (8-pin SOIC package)
__	1	MCP23017 I2C Port Expander (24-pin large SOIC package)
__	6	VN5E160S Drivers (SOIC-8 package)
__	1	IRLU3636PBF Power MOSFET (3 leads, marked "AULU3114Z" or "IRLU3636")
__	1	FERD30H100SB Rectifier (3-leads, marked "FERD30H")
__	1	LD1117-33 3.3V voltage regulator (SOT-223 package)
__	1	SI2302 FET (very small part with 3 leads)
__	1	FODM217DV Optoisolator (4-pin SOIC package)
__	1	10mm magnetic buzzer
__	1	330 ohm 1206 resistor (marked "331")
__	1	1K 1206 resistor (marked "102")
__	4	4.7K 1206 resistor (marked "472")
__	5	10K 1206 resistors (marked "103")
__	1	22K 1206 resistor (marked "223")
__	6	100K 1206 resistors (marked "104")
__	3	.1 uF 1206 ceramic multilayer capacitor (brown) (not marked, but it's in a PAPER carrier)
__	2	10 uF 1206 ceramic multilayer capacitors (brown) (not marked, but they're in a CLEAR PLASTIC carrier OR a paper carrier with a RED stripe)
__	4	1/8W resistors (value not important… we're just using them for the leads)
__	1	2-pin header
__	1	4-pin right-angle header
__	2	6-pin 2.54mm screw terminal blocks
__	1	Coil of .020" 63/37 No-Clean solder wire



Note that some of the components are static sensitive, so you should avoid sources of static electricity while you are handling them. We recommend that you assemble the Proton on a wood or metal surface unless you are fortunate enough to have a high-temperature anti-static mat (don't buy one just to build the Proton, however!) Avoid putting it on plastic surfaces that generate static, and preferably put it together in a room that's not carpeted. That being said, it's very unlikely that you will zap any of the components in the Proton with static electricity, but consider yourself notified of the possibility…

Also note that some of the components are polarized, i.e. it matters which way you put them in. If you solder one of these components in backwards, the effect will range from something not making a noise (buzzer) to nothing at all working. It is CRITICAL that you test-fit the parts before you solder, and that you make ***SURE*** that you have them pointed the right direction before soldering. Like the old adage says, "Measure twice, cut once." If you solder a part onto the board incorrectly, it can be a minor pain to remove if it only has two pins, or it can be virtually impossible for something with a lot of pins. ***The Proton Limited Warranty does not cover incorrect assembly***, so if you mess up badly enough you may end up having to get another kit and starting over; neither of us want that.

It is very important that you assemble the Proton in the order listed. This makes it easier to access the surface-mount components; if you start soldering out of order it's going to be tough for you to get to the pads of the SMT parts. Some of the instructions may call for you to tack-tape parts to the board to maintain alignment while you solder. You should ONLY use paper masking tape for that purpose, DO NOT use "Scotch"® tape or electrical tape for this; plastic tapes can pick up static electricity and damage parts, and electrical tape tends to leave a sticky residue.

If you have any questions about the assembly, please send us an email, to support@eggtimerrocketry.com , BEFORE you start building. If you're in the middle of building and have a question, STOP. It's much harder to go back later and fix something than it is to wait a little bit for the answer to your question. We generally answer all questions the same working day, and we do our best to ensure your success.

Before you solder anything, make ***absolutely*** sure that you have the correct part and that it is inserted in the board correctly. The board has all of the component values, outlines, and polarities silk-screened on the top, so there shouldn't be any doubt about what goes where and how. Nevertheless, if you have any questions about the assembly procedure, do not hesitate to drop us a line at support@eggtimerrocketry.com before you solder the parts to the board. You may have to wait a day for the answer, but it could save you a lot of grief later on!

The Proton Limited Warranty does not cover damage to parts while attempting to desolder them because you inserted something incorrectly. We spent a lot of time making sure that the assembly instructions were clear, but once again if you have any questions about the assembly procedures drop us a line at support@eggtimerrockety.com ***before*** you solder.

OK, so let's get started…

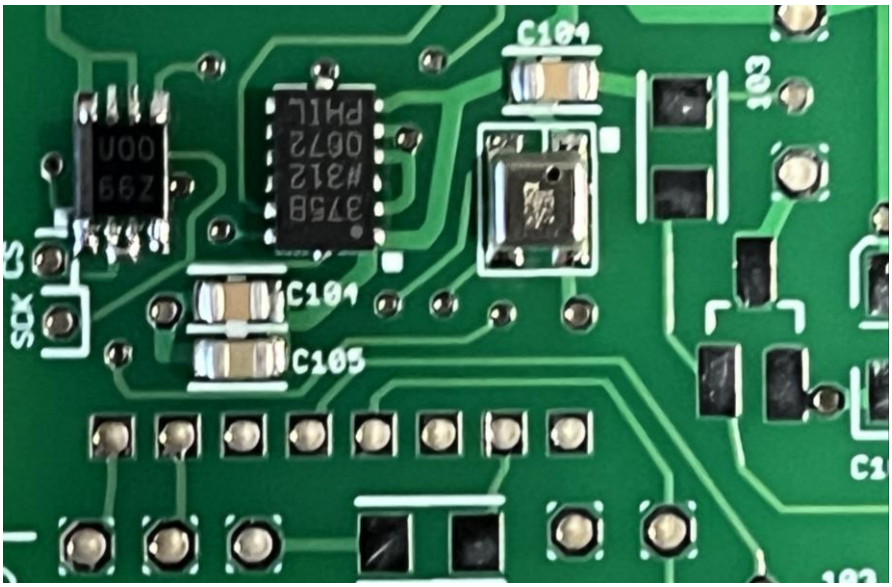
Inspect the Sensor Components

The sensor components on the Proton come pre-installed on the PC board, using an automated pick and place machine and a reflow oven. We inspect the board three times before packaging it… when it comes out of the pick and place machine, after it comes out of the oven, and finally right before we put it in the anti-static bag.

Nevertheless, we are human and we can still make mistakes. We recommend that you take a look at the sensor components with your magnifying glass before you solder to the board. You should look for:

- Any components that appear not to be "square" to the pads
- The orientation of the components, compare them to the picture below
- That the little 8-pin chip on the left side of the board is sitting on the pads
- That the rectangular accelerometer chip is nicely centered in the box
- Note that it's OK if the C104 and C105 capacitors are slightly crooked… there's a lot of room to play with there (even though they look really small).

If you see anything that does not look exactly like the picture, DO NOT START BUILDING THE KIT. Send us an email, to support@eggtimerrocketry.com , along with a close-up picture of your board. We'll let you know if there's a problem or not, and if there is we'll probably send you a replacement board.



Mounting the Bottom-Side SMT Parts

There are parts mounted on both sides of the Proton board, this is done to save space. It does make the assembly task a little bit more complicated, but in general most of the smaller parts are mounted on the "bottom" side of the board (i.e. the side that you don't see when it's mounted in your AV bay), so the "top" side of the board is pretty easy. We're going to do the SMT parts on the bottom side, then flip it over and do the top side, then go back and do the through-hole parts that are all on the top side.

If you are using a hobby vise or similar PC board holder…

__ Mount the board in your PC board holder so that the side with the pre-mounted sensor components faces up and to the left. This is the side that you will working with.

If you are NOT using a hobby vise or some kind of holder…

___ Turn the board so that the so that the side with the pre-mounted sensor components faces up and to the left. This is the side that you will working with.

___ With some masking tape, tape the board to your work table, the overlap of the tape on the board should be no more than about ¼".

___ Mount the SI2302 FET

Locate the spot for the SI2302 FET just to the lower-right side of the silver baro sensor chip, it has two pads on the bottom side and one on the top. Melt just a tiny bit of solder on the upper pad on the PC board. Carefully remove the FET from its package (yes, it's very small… be careful not to drop it!) and place it over the pads. While holding it in place with tweezers, melt the solder so that it stays in place. Solder the other two pads, then touch up the top pad if the solder joint doesn't look 100% good. Inspect the solder joints with a 10x jeweler's loupe afterwards and touch up any solder joints that don't look right.

__ Mount the Optoisolator

Find the optoisolator, it's a 4-pin chip marked "217D". Locate the spot for the optoisolator, it's a 4-pin chip near the upper-left edge of the board. Remove the optoisolator from it's package, you'll notice that there's a "dot" in one corner of the chip. That dot needs to match up with the little square that's marked on the lower-right corner of the pad outline, that's Pin 1.

Melt just a tiny bit of solder on the Pin 1 pad on the PC board. Hold the optoisolator in place on the board with tweezers, then melt the solder so that it stays in place. Make sure that the chip's leads are centered on the pads. After you're satisfied that all of the leads are centered on the pads, solder the other leads one by one until they're all done. If necessary, go back and solder the Pin 1 pad.

__ Mount the interface chip

Locate the spot for the interface chip in the middle of the board, it's the very large (by comparison…) chip with 28 pins. Note that the upper-right corner of the outline has a square marked on it, that's the Pin 1 mark that corresponds to the Pin 1 dot that's on the interface chip.

Melt just a tiny bit of solder on the Pin 1 pad on the PC board. Remove the accelerometer chip from its package, and while holding it in place with tweezers melt the solder so that it stays in place. Make sure that the interface chip's leads are centered on the pads… since it's such a large chip, it may take a few tries to get it right.

Solder the opposite corner of the interface chip. Check the alignment again, when you're satisfied with the alignment solder the remaining pads, and touch up Pad 1 if you need to. Note that you do not need to put a big glob of solder on these pads (or any of the other pads,

for that matter…), you just need enough so that the solder attaches the lead to the PC board's pad.

Inspect the solder joints with a 10x jeweler's loupe, and touch up any pads that do not appear to be correct. In particular, makes sure that the solder is actually touching the pads, and not just sitting on top of the chip's leads.

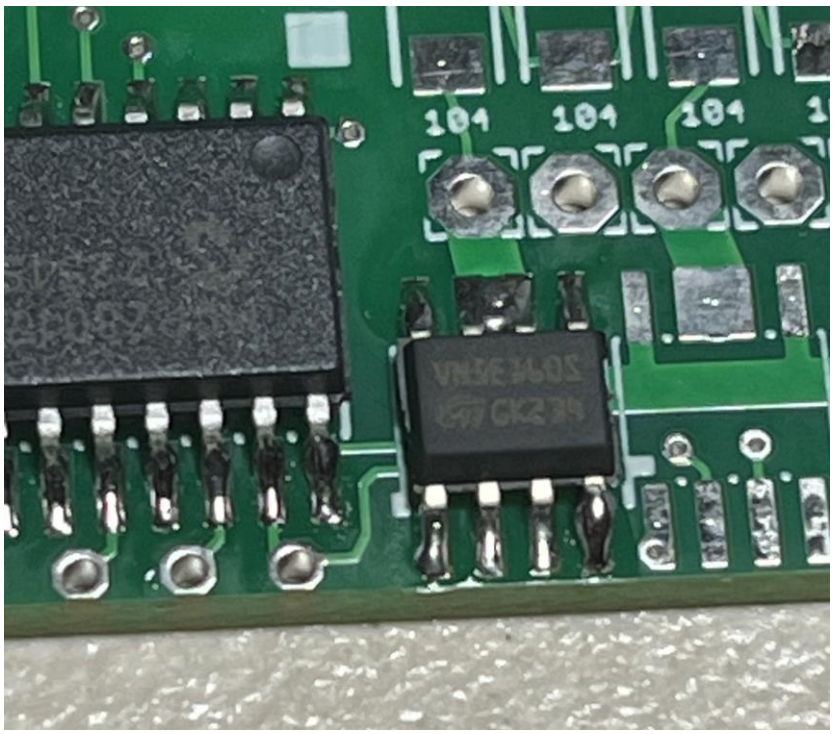
__ Mount the first three drivers

Locate the six driver chip spots, there are three of them on either edge of the right side of the board. Note that they DO NOT all face the same direction… the writing on the driver chips must face the NEAR edge of the board if you turn it in that direction. Unfortunately, there is no Pin 1 mark on the driver chips, Pin 1 is the left-most bottom pin if you hold the chip so that the writing is rightside-up. There is also a bevel on the edge of the Pin 1 side; the other side is squared. BE VERY CAREFUL WHEN YOU ARE MOUNTING THEM TO GET THE ORIENTATION CORRECT!

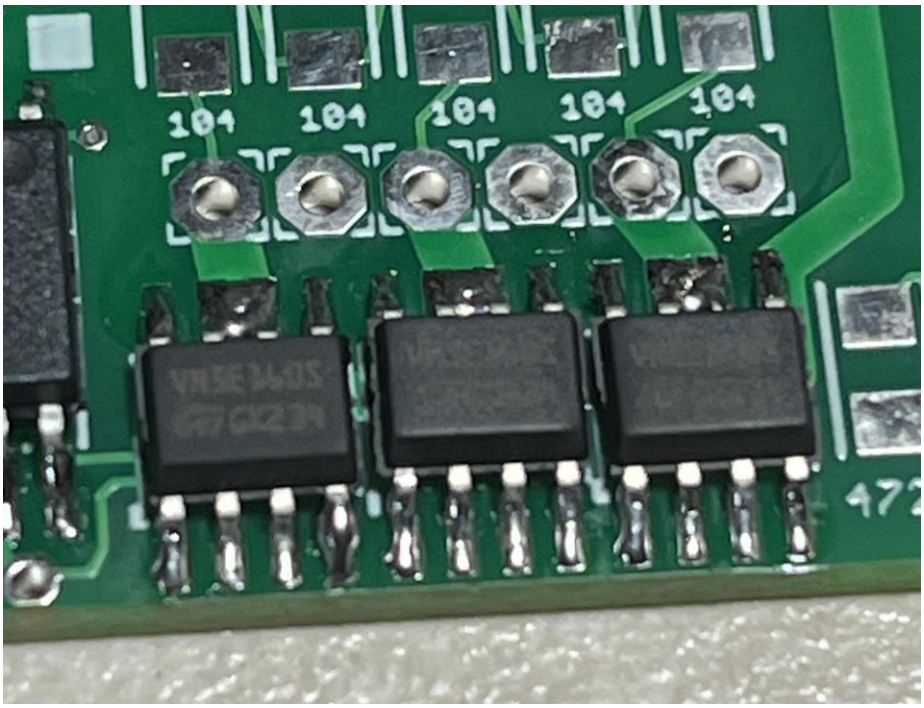
You are going to be mounting the driver chips from left to right. For the left-most driver chip, locate the Pin 1 marking at the lower-left side of the pads. You will see that on the OPPOSITE side there are two pads in the middle that are bonded together… melt a little bit of solder on those pads. Remove one driver chip from its package, and place it on the pads so that the writing is right-side up, i.e. so that the “VN5E160S” logo is on the side that you just tinned. While holding it in place with tweezers melt the solder so that it stays in place. Make sure that the driver chip's leads are centered on all of the pads, it's important that you do not mount it crooked.

Check the alignment again, when you're satisfied with the alignment solder the remaining pads, and touch up the large pad if you need to. Note that you do not need to put a big glob of solder on these pads (or any of the other pads, for that matter…), you just need enough so that the solder attaches the lead to the PC board's pad.

Inspect the solder joints with a 10x jeweler's loupe, and touch up any pads that do not appear to be correct. In particular, makes sure that the solder is actually touching the pads, and not just sitting on top of the chip's leads. Note that it is VERY easy to get solder on top of the leads but not on the pads, so inspect this carefully.



Now, repeat the procedure for the other two driver chips on that side of the board. Be sure to carefully align the chips so that they are centered on the pads, don't use more solder than you need to, and inspect the solder joints with a 10x jeweler's loupe afterwards and touch up any solder joints that don't look right.



___ Mount the other three drivers

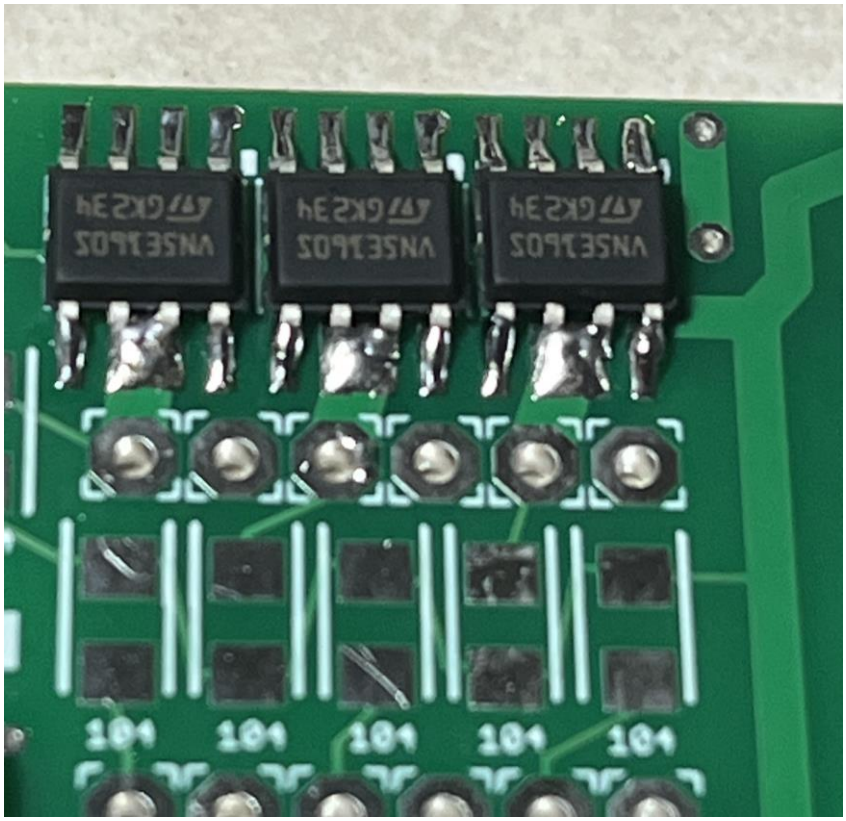
Untape your board from the work table, and turn it around 180 degrees so that you're looking at the empty edge of the board, the three empty driver spots should be at the bottom left side of the board. Look at the left-most driver's pads, you'll see that there is a Pin 1 marking on the lower-left side of the pads.

You will see that on the OPPOSITE side there are two pads in the middle that are bonded together… melt a little bit of solder on those pads. Remove one driver chip from its package, and place it on the pads so that the writing is right-side up, i.e. so that the "VN5E160S" logo is on the side that you just tinned. While holding it in place with tweezers melt the solder so that it stays in place. Make sure that the driver chip's leads are centered on all of the pads, it's important that you do not mount it crooked.

Check the alignment again, when you're satisfied with the alignment solder the remaining pads, and touch up the large pad if you need to. Note that you do not need to put a big glob of solder on these pads (or any of the other pads, for that matter…), you just need enough so that the solder attaches the lead to the PC board's pad.

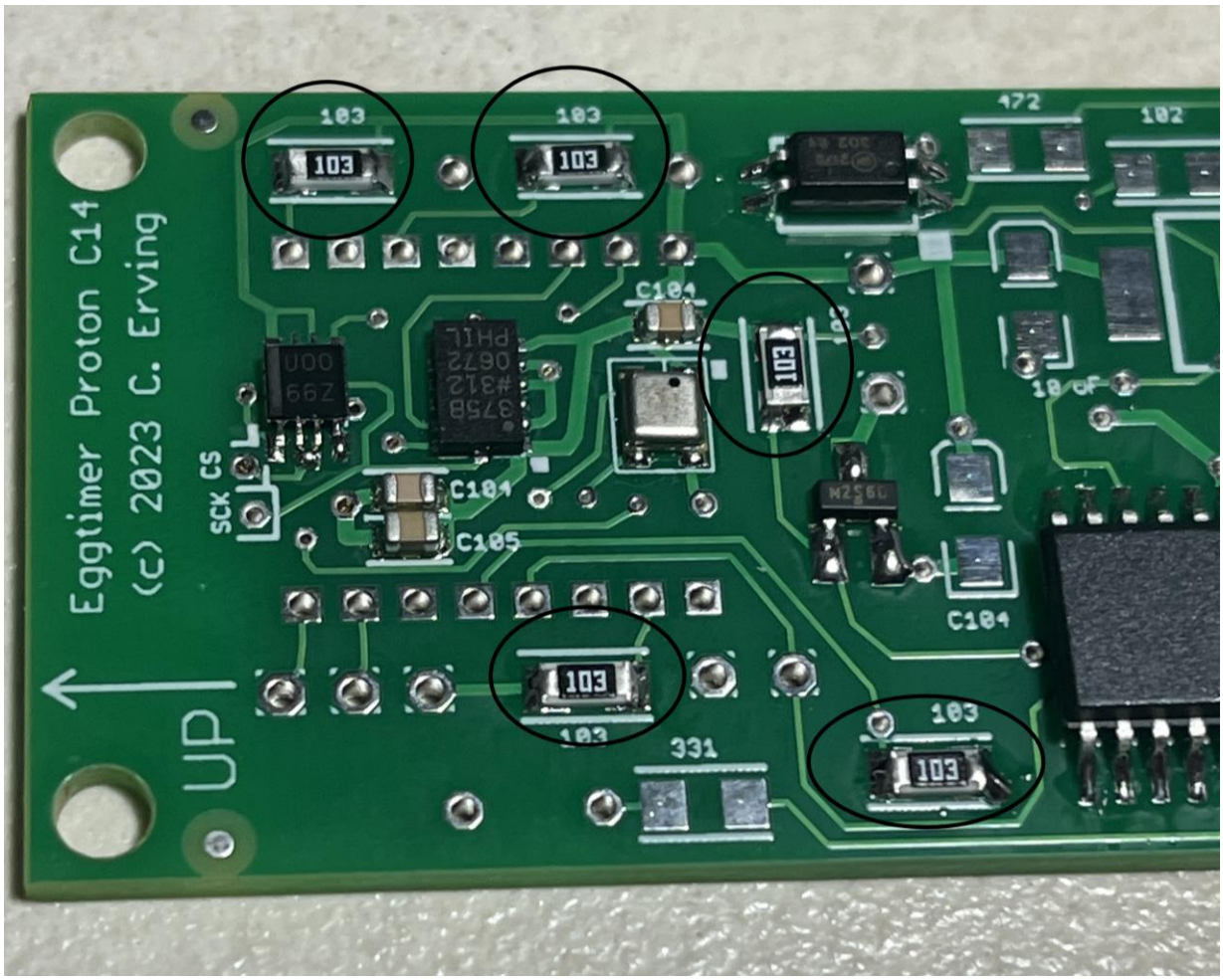
Inspect the solder joints with a 10x jeweler's loupe, and touch up any pads that do not appear to be correct. In particular, makes sure that the solder is actually touching the pads, and not just sitting on top of the chip's leads

Now, repeat the procedure for the other two driver chips on that side of the board. Be sure to carefully align the chips so that they are centered on the pads, don't use more solder than you need to, and inspect the solder joints with a 10x jeweler's loupe afterwards and touch up any solder joints that don't look right.



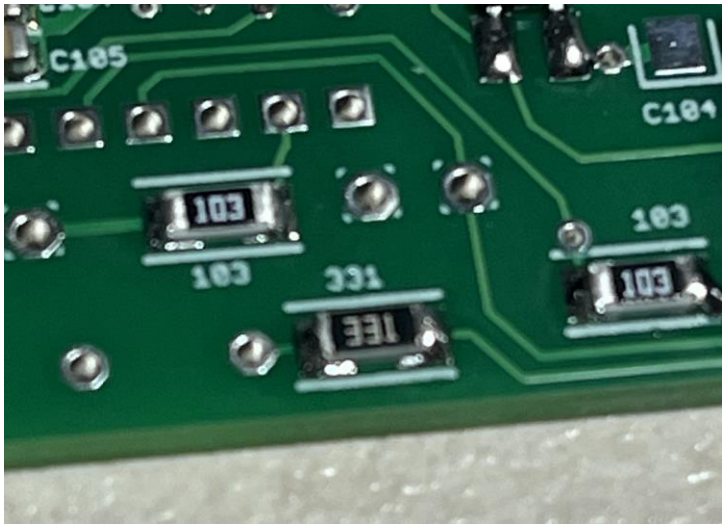
___ Mount the five 10K (103) resistors

Locate the 10K resistors (marked 103), there will be three of them surrounding the row of pads for the WiFi chip, one just above the SI2302 FET, and one to the lower-left side of the interface chip. Solder in place and inspect the solder joints with a 10x jeweler's loupe afterwards and touch up any solder joints that don't look right.



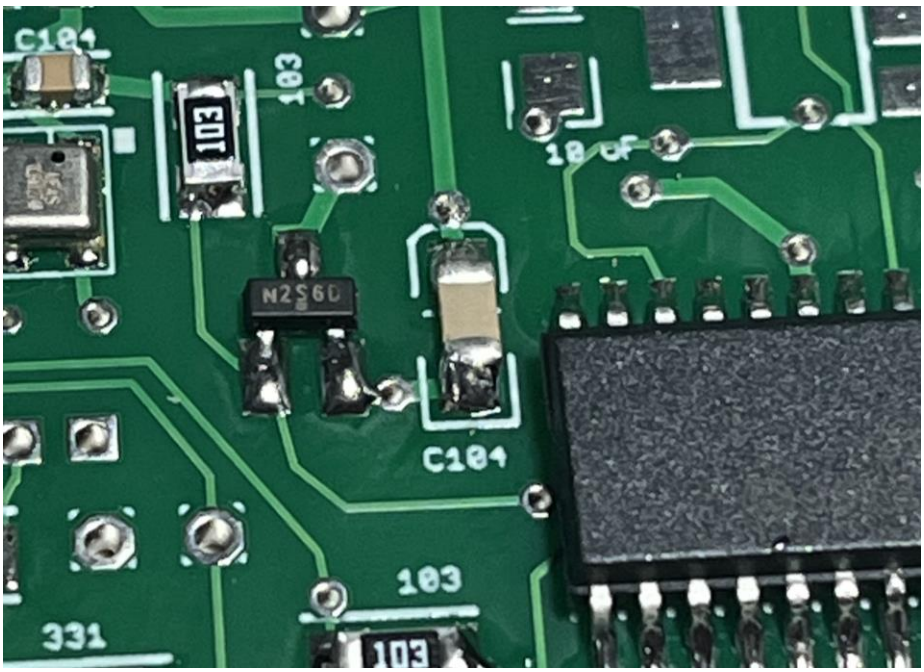
___ Mount the 330 ohm (331) resistor

Locate the 330 ohm resistor (marked 331), it's on the bottom-left edge of the board. Solder in place and inspect the solder joints with a 10x jeweler's loupe afterwards and touch up any solder joints that don't look right.



__ Mount the .1uF capacitor

Locate the spot for the three .1 uF capacitor, just to the right of the SI2302 FET. Solder in place and inspect the solder joints with a 10x jeweler's loupe afterwards and touch up any solder joints that don't look right.

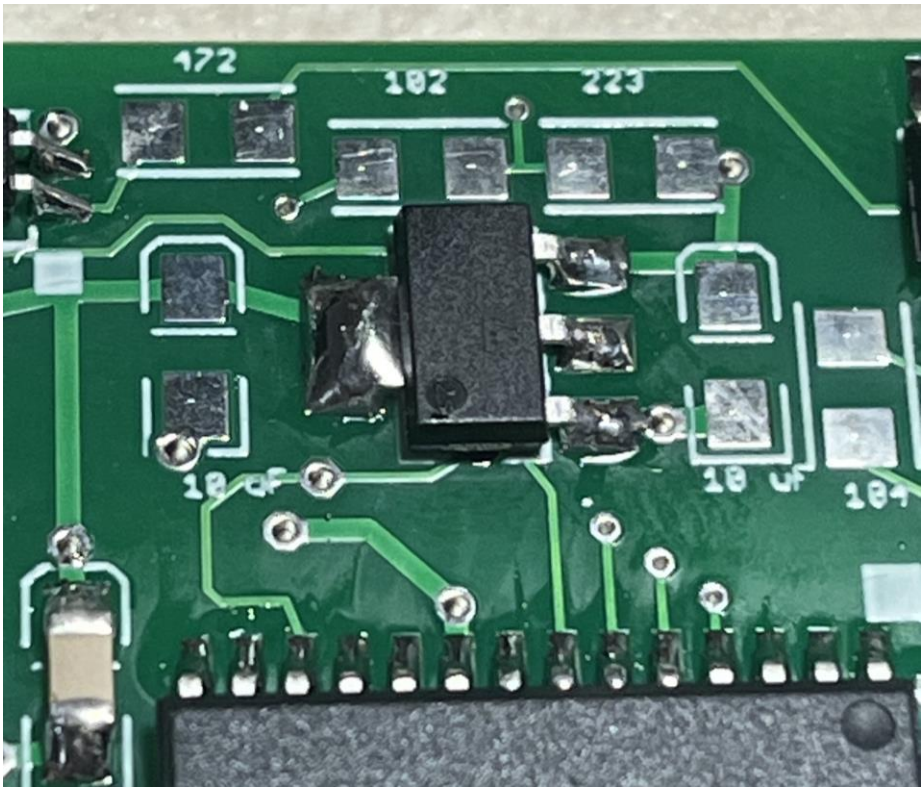


___ Mount the voltage regulator

Locate the large pad and the three small pads for the voltage regulator. Heat up the large pad with your soldering iron and melt a very small amount of solder on the large pad, just enough to cover it. Place the voltage regulator IC in place, and hold it down, then heat up the large pad on the voltage regulator until the solder starts to flow. Hold your soldering iron on the pad for another 5 seconds, then remove it and wait at least 10 seconds. This should hold the regulator in place.

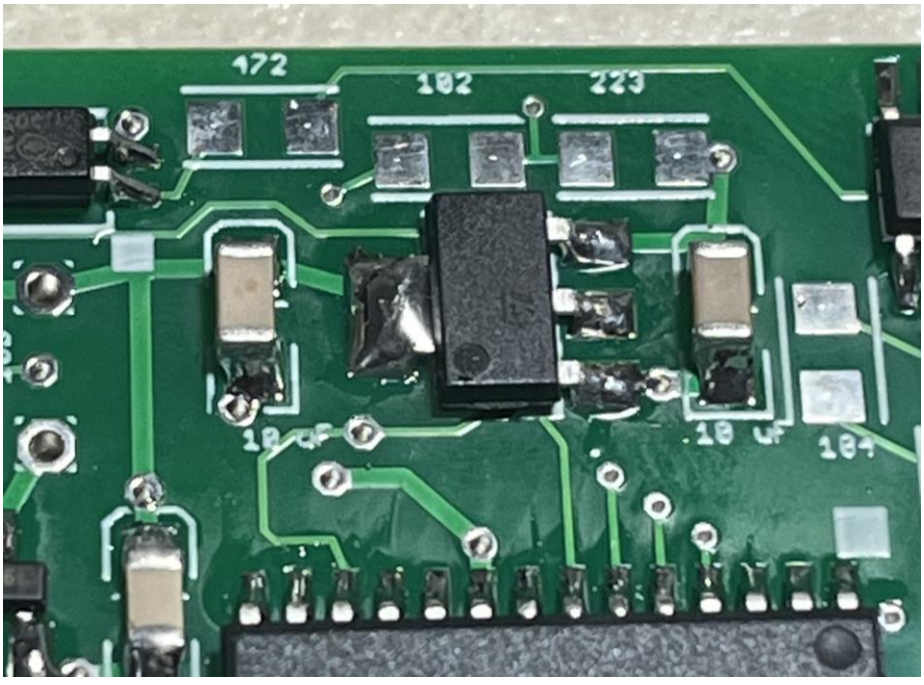
One by one, solder the three small three small leads to the pads, using enough solder to cover the pad and get a good “tenting” on the leads without creating solder “blobs”. Wait at least 30 seconds between each pad to prevent the chip from overheating.

Now go back and heat up the tab again and flow more solder on the large pad, covering it and the tab with solder. You don’t want a great big blob of solder, but you do want enough so that the tab is covered. This ensures that the pad underneath is well bonded to the tab, and the solder/tab acts as a heat sink for the regulator.



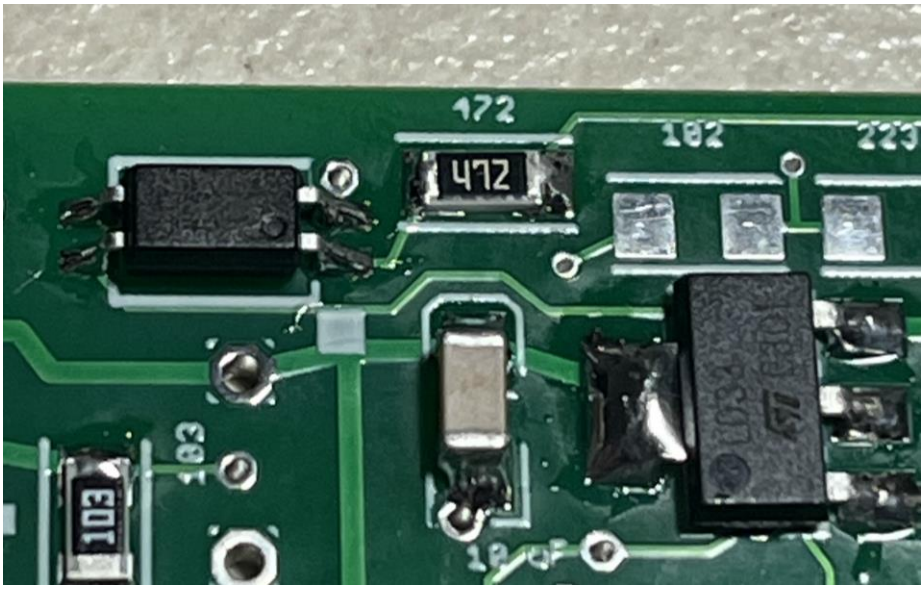
___ Mount the two 10 uF capacitors

Locate the two 10 uF capacitors, one on either side of the voltage regulator. The 10 uF capacitors usually come in a clear unmarked tape, and there will be exactly two of them in your kit. Solder in place and inspect the solder joints with a 10x jeweler's loupe afterwards and touch up any solder joints that don't look right.



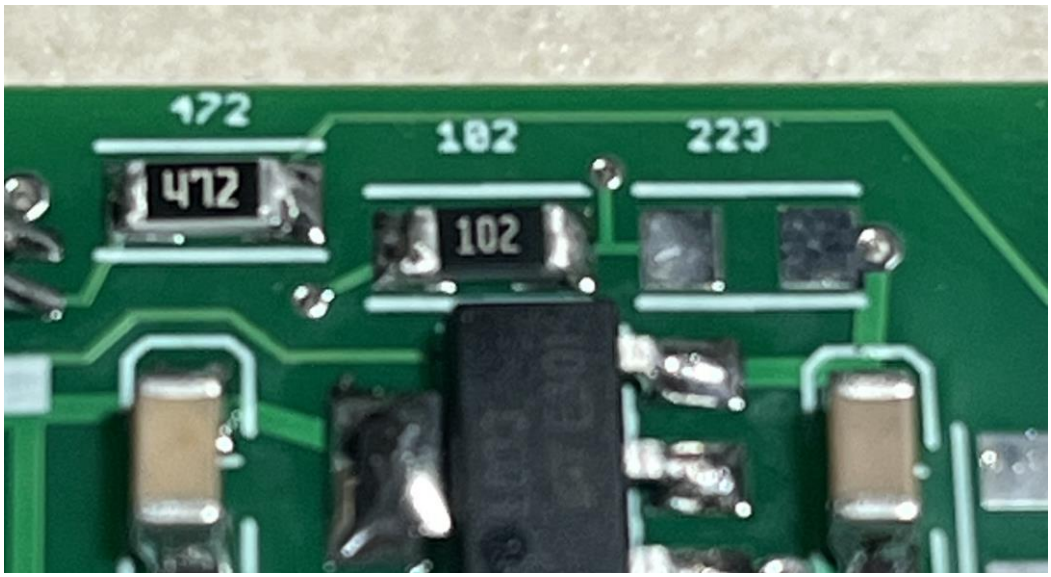
___ Mount the 4.7K (472) resistor

Locate the 4.7K resistor (marked “472”) just to the right of the optoisolator. Solder in place and inspect the solder joints with a 10x jeweler's loupe afterwards and touch up any solder joints that don't look right.



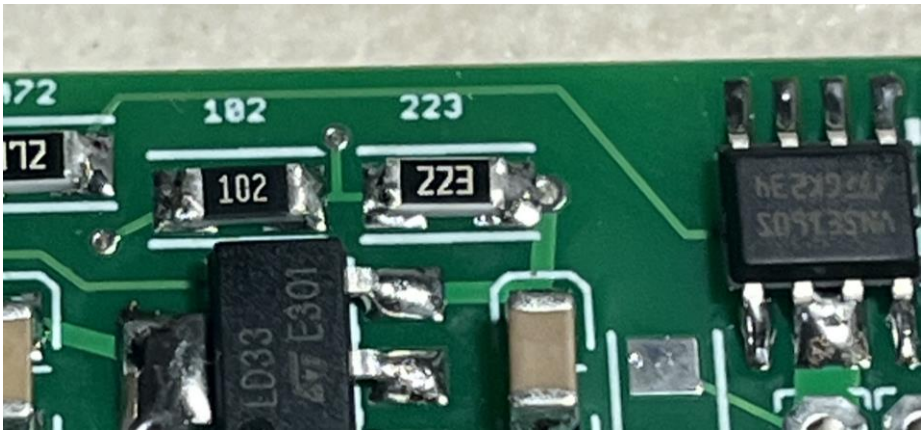
___ Mount the 1K (102) resistor

Locate the 1K resistor (marked 102), it's on the top-center edge of the board just above the voltage regulator. Solder in place and inspect the solder joints with a 10x jeweler's loupe afterwards and touch up any solder joints that don't look right.



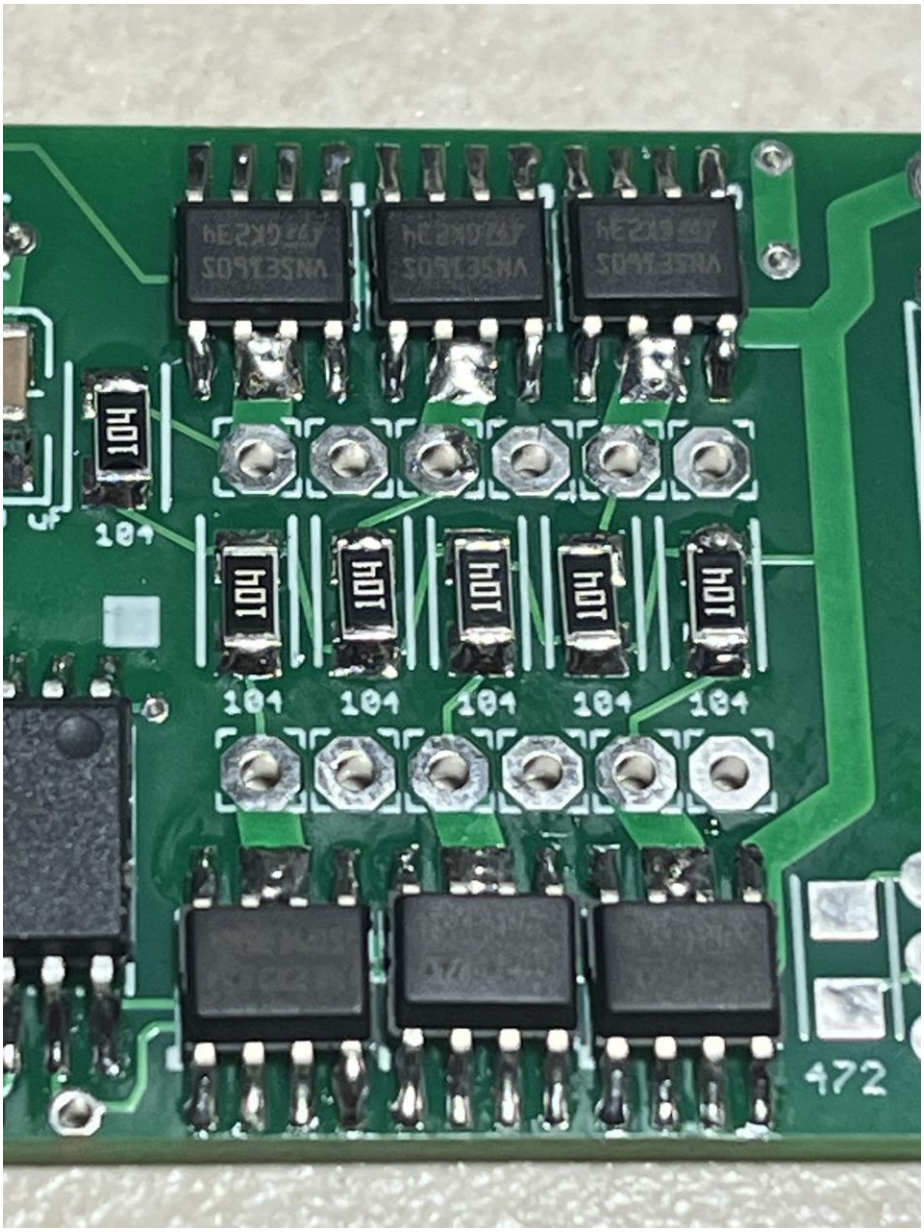
___ Mount the 22K (223) resistor

Locate the 22K resistor (marked 223), it's on the top-center edge of the board. Solder in place and inspect the solder joints with a 10x jeweler's loupe afterwards and touch up any solder joints that don't look right.



___ Mount the six 100K (104) resistors

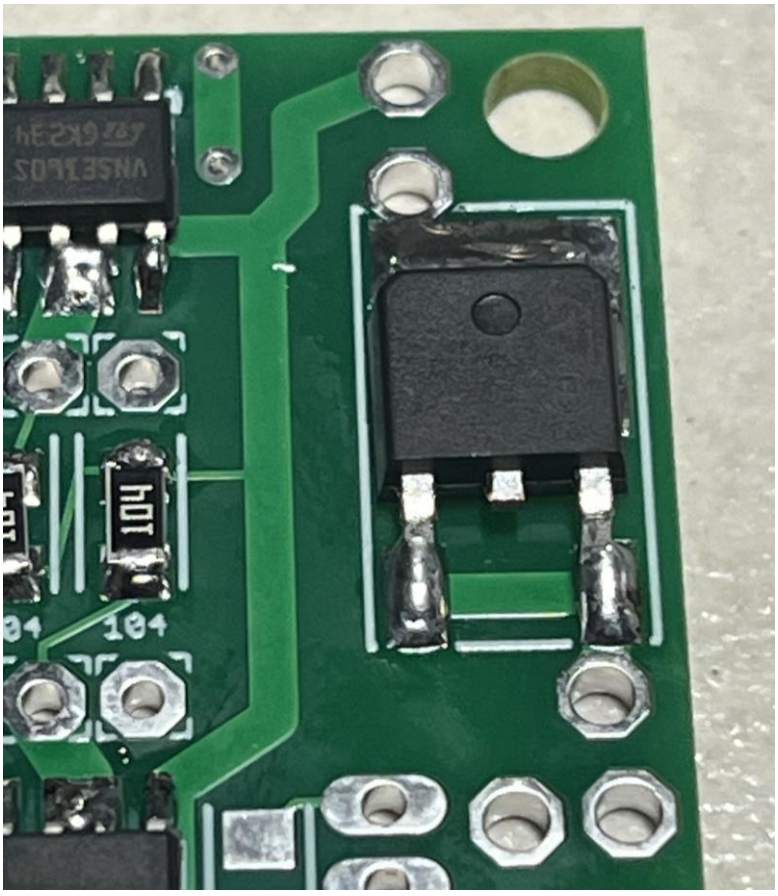
Locate the six 100K resistors (marked 104), one of them is to the right of the voltage regulator and the other five are in between the six driver chips. Solder in place and inspect the solder joints with a 10x jeweler's loupe afterwards and touch up any solder joints that don't look right.



__ Mount the Rectifier

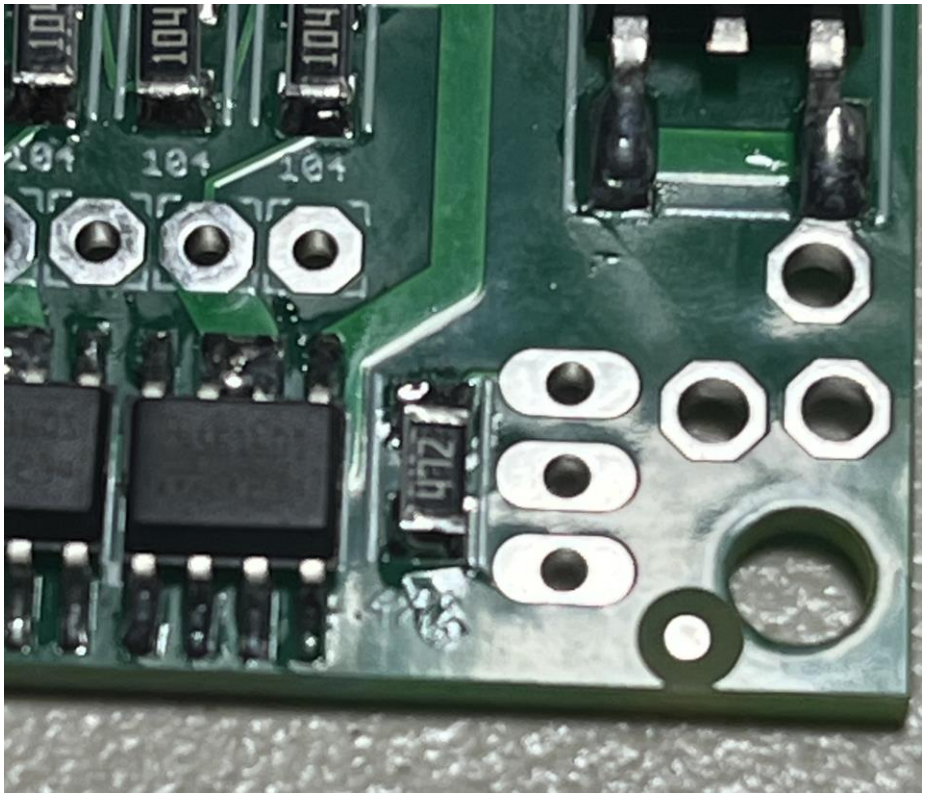
Locate the spot for the rectifier on the far right side of the board, there is a large pad and two smaller pads below it. Lightly tin the large pad, using just a thin layer of solder. Tin the lower-right smaller pad with a little more solder. Hold the rectifier in place with tweezers, and heat up the lower-right pad until the tinned solder beneath it melts; hold the heat for a few more seconds, then carefully withdraw your iron and let it cool for several seconds before you release it. Solder the other smaller pad generously, then go back and resolder the first pad generously.

Now, hold your iron on the tab over the large pad for several seconds until the tinned solder starts to melt, then apply solder to the joint between the tab and the PC board pad. Be generous with the solder here… it has to take a lot of current and act as a heat sink. Don't be surprised if it takes awhile to heat up the pad… it's much larger than the other parts on the board.



___ Mount the 4.7K (472) resistor

Locate the 4.7K resistor (marked “472”) near the far right edge of the board, next to the bottom row of driver chips. Solder in place and inspect the solder joints with a 10x jeweler's loupe afterwards and touch up any solder joints that don't look right.



Mounting the Top-Side SMT Parts

__ Orient the board

If you're using a vise or similar PC board holder…

Turn the board so that the outline of the WiFi module (the big rectangle with the 16 pads) is facing up and to the right. The pads marked "BATT" should be on the left side.

If you're NOT using a vise or PC board holder…

Turn the board so that the sensors are facing up and to the right., with the rectifier to the left. Cut a piece of masking tape about ½" square. Using the tape, tape a round toothpick on top of the right edge of the board, being careful not to get any tape on the parts.

Now turn the board over so that the outline of the WiFi module (the big rectangle with the 16 pads) is facing up and to the right. The toothpick on the right and the rectifier on the left should hold the board roughly flat, so you can tape the board down to your worktable by the edges if necessary.

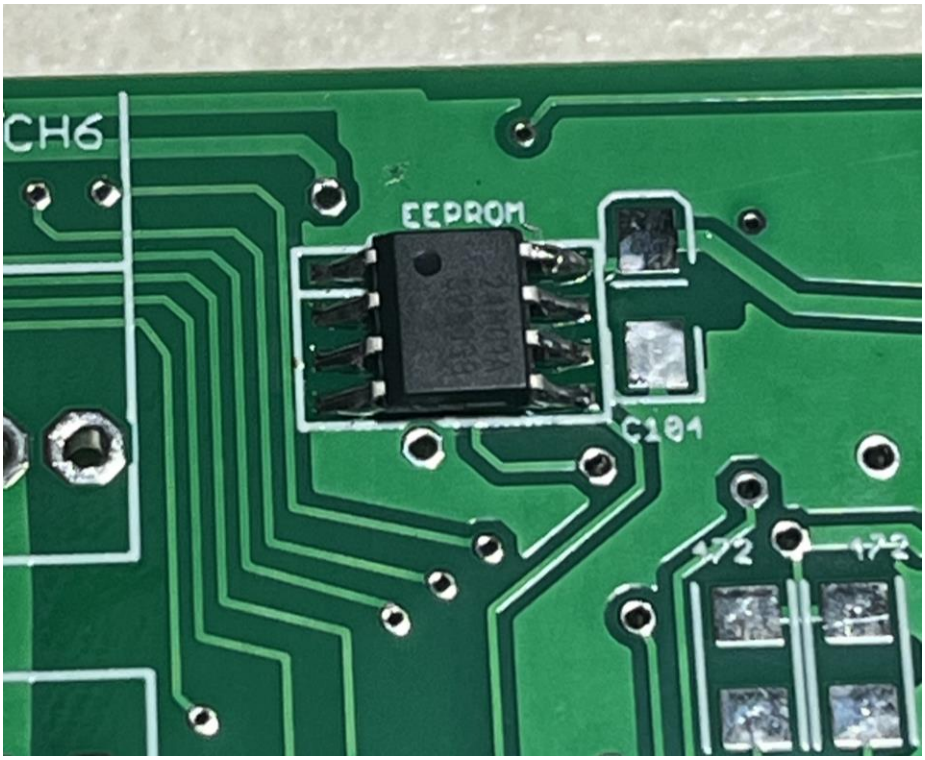
__ Mount the CAT24M01 EEPROM

Locate the spot for the EEPROM, it's the 8 pads just to the left of the top-center of the board. Remove the EEPROM from its package, you'll see that there is a dot at one corner of the chip. This corresponds to the little square that's marked at the top-left pad, that's the Pin 1 marking.

Tin the upper-right pad with just a little bit of solder. With tweezers, hold the EEPROM in place, and heat the lead over the tinned pad until the solder melts. Keep the heat on for another 3-4 seconds, then remove the iron and let the pad cool.

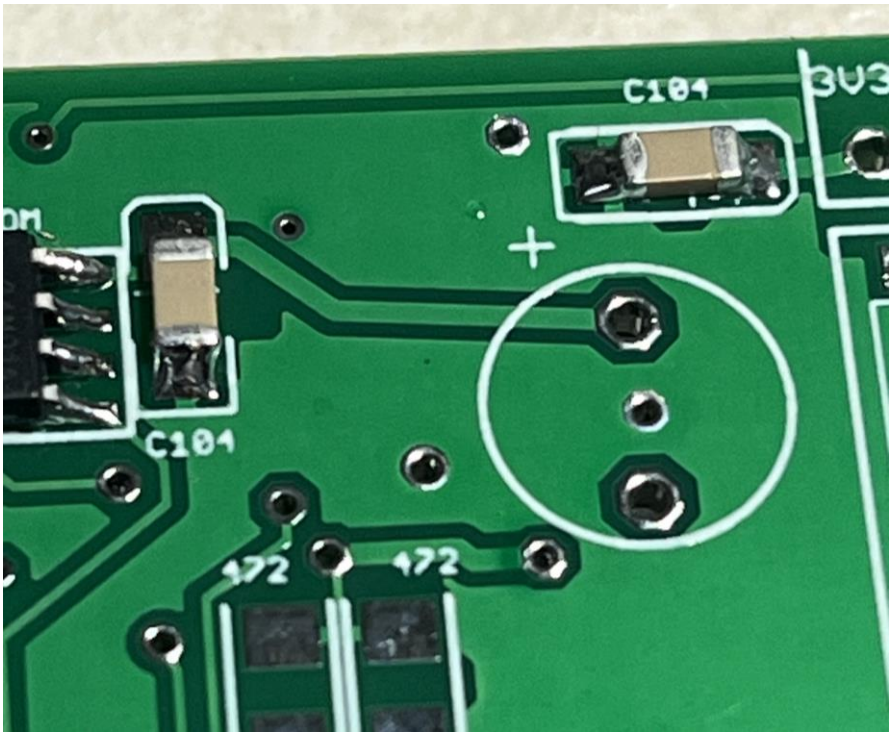
Check the alignment of the EEPROM on the pads, all of the leads should be centered on the pads. If not, heat up the lead and carefully move the EEPROM in place.

Once you're satisfied with the alignment, carefully solder the remaining leads to the pads, waiting 15 seconds between each lead so that the device has a chance to cool down a bit. We recommend that you do the corners first, to help keep the EEPROM in alignment with the pads. When you're done, get out the 10x jeweler's loupe and inspect each solder joint carefully, making sure that the solder contacts both the pad and the leads, and that there are no solder bridges between the pads. If you find one, get out the solder wick and remove any excess solder before resoldering the pads.



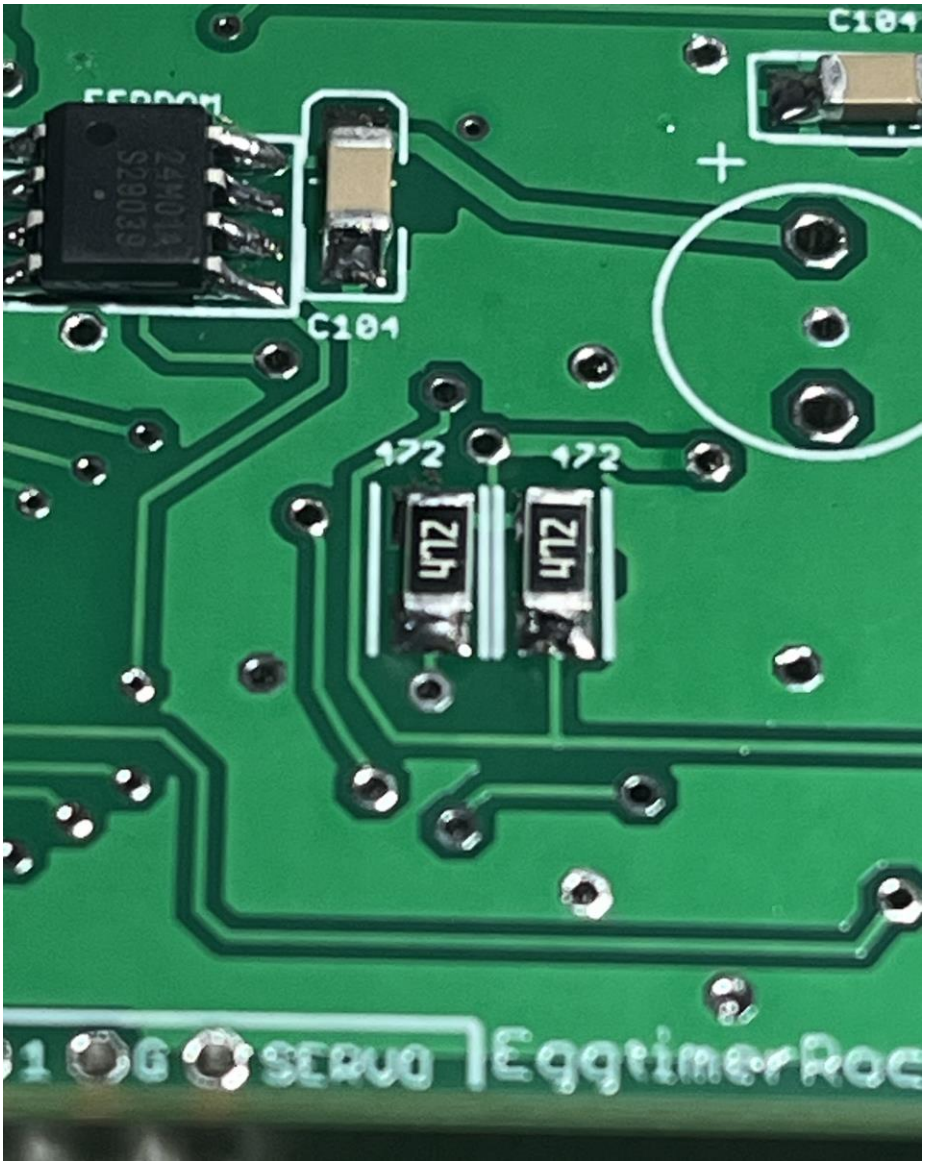
__ Mount the two .1uF capacitors

Locate the spot for the three .1 uF capacitors, one is just to the right of the EEPROM, and one is just above the circle for the buzzer. Solder in place and inspect the solder joints with a 10x jeweler's loupe afterwards and touch up any solder joints that don't look right.



___ Mount the two 4.7K (472) resistors

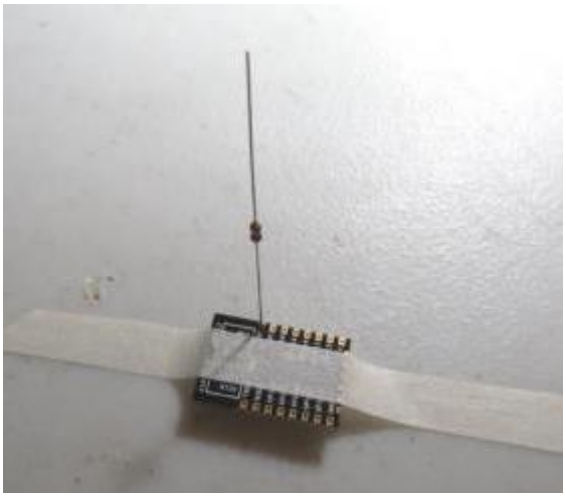
Locate the 4.7K resistors (marked “472”) near the center of the board. Solder in place and inspect the solder joints with a 10x jeweler's loupe afterwards and touch up any solder joints that don't look right.



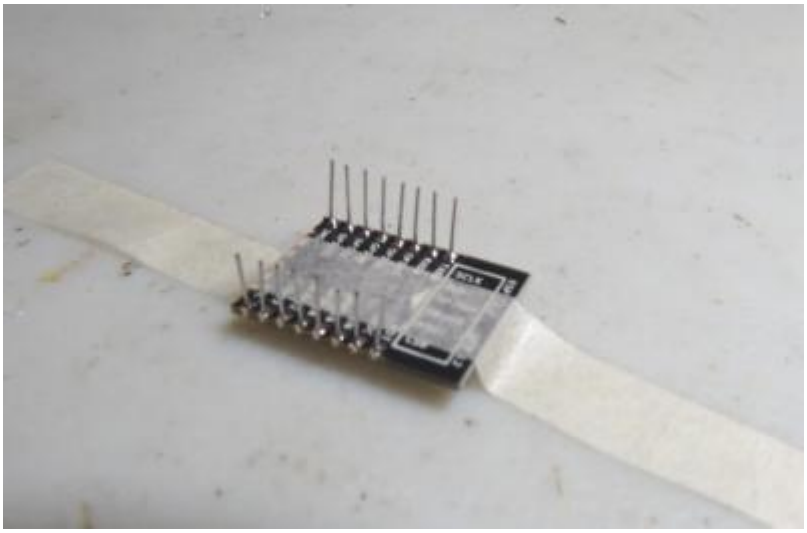
Mounting the ESP8266-12 WiFi Module

Carefully remove the ESP8266-12 WiFi module from the antistatic baggie in which it was shipped. **(Be sure to keep the baggie, it has the 8-digit passkey that you'll need to connect to your WiFi device!)** Note that one end has a "squiggly" line and sticks out, this is the antenna side, be sure to line it up with the left side of the PC board.

Cut a piece of paper masking tape about ¼" wide and 3" long. Tape the WiFi module to your work tape upside down, so that the metal shield is facing down. Take one of the 1/8W leaded resistors and put it into one of the corner holes of the WiFi module. Yes, it will stick up a lot. Solder the lead to the pad, holding the resistor straight up, then clip the lead off half-way to the resistor body. You don't need a lot of solder, just enough to fill the hole and ensure that the lead is well attached. Insert the resistor's leads into the next hole, and similarly solder it.



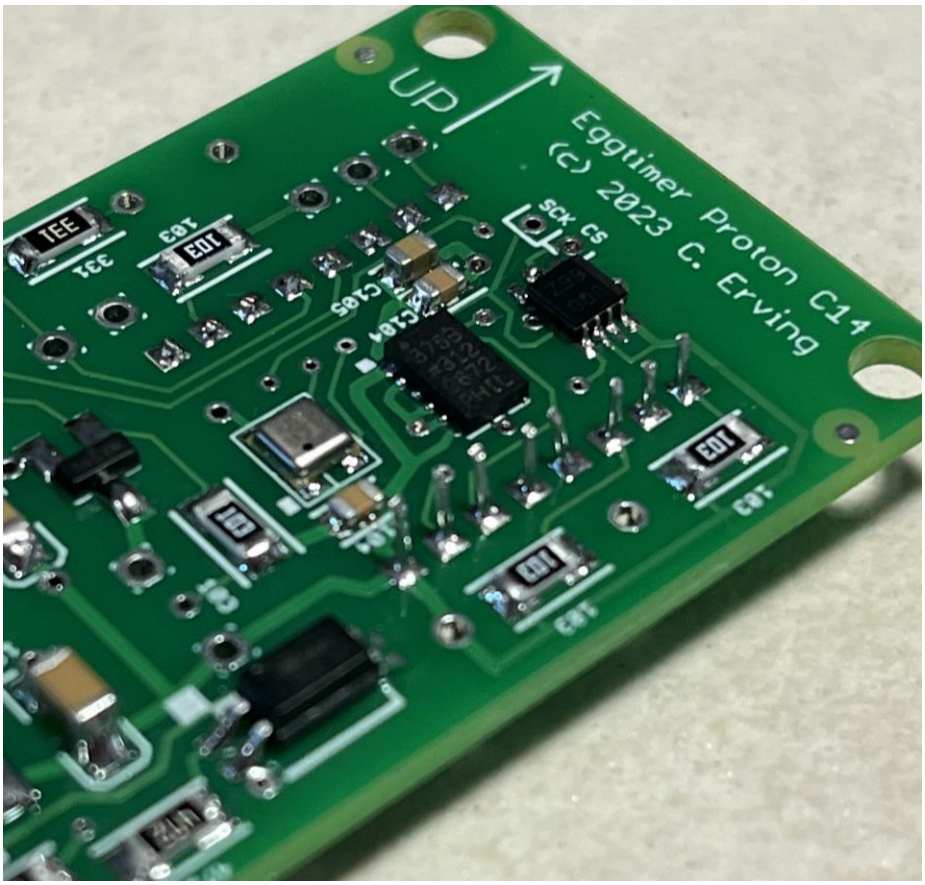
As you clip the resistors' leads, insert it into the next pad, then solder it to that pad. After the second lead on each side, clip it at the resistor body. When you are completely done, there will be a lead on each pad, about ½" long.



Untape the WiFi module from your work table and turn it over so that the TOP side (with the metal shield) is now up. You will have a short wire sticking out of each pad on the TOP of the WiFi module. With a pair of fine diagonal cutters, clip the stubby lead off close to the WiFi module's PC board. It doesn't matter if you have a little bit left, but it matters a lot if you wedge a little piece of the cut leads in the module somewhere, so inspect it carefully to make sure that they're all cut completely off.

Afterwards, turn the WiFi module over, and with your diagonal pliers even out the leads so that they're the same length. Carefully line up the leads with the holes for the WiFi module markings on the TOP of the PC board, and gently work it into the holes until it's about 1/32" above the board.

Now, turn the board over so the WiFi module is on the bottom, and solder the leads to the boards. Again, use only enough solder to ensure that you have a good mechanical connection. You may want to clip the leads as you go, making sure that the remnants don't land somewhere on the board.



Note: The leads on the near side of this picture have NOT been clipped for clarity… be sure to clip ALL 16 of them!

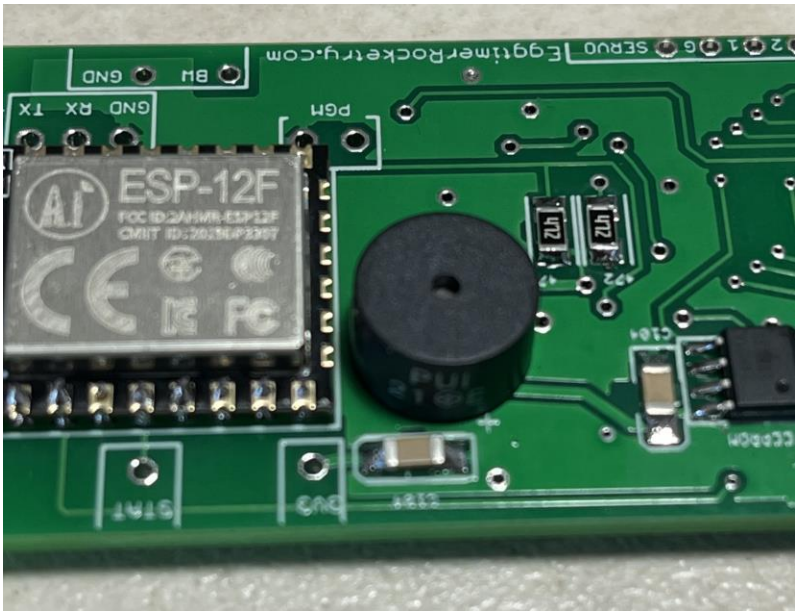
When you are done, all 16 pads (8 on each side) should be soldered on the bottom of the board, and all 16 pads on the WiFi module should be soldered. Inspect the solder joints carefully, and touch up any that look incomplete, particularly the two end pads… they provide the power and ground connections from the board. If you didn't clip the leads before, clip them all now.

Note: Your WiFi module may have six extra pads opposite the antenna, do not solder these or do anything at all with them.

Mounting the Rest of the Top-Mount Parts

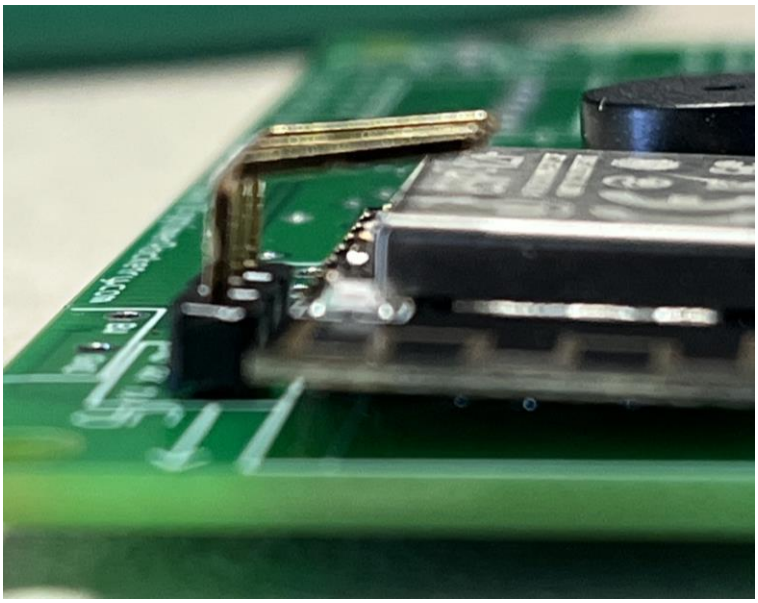
__ Mount the Buzzer

Locate the buzzer, it's just to the right of the middle of the board. Note that it's polarized, one lead is marked "+" and it's also longer than the other lead. Place on the board matching up the "+" with the "+" marking on the board, hold in place with masking tape, then turn over the board and solder in place. Clip the leads flush, you can also remove the paper tab over the hole now.



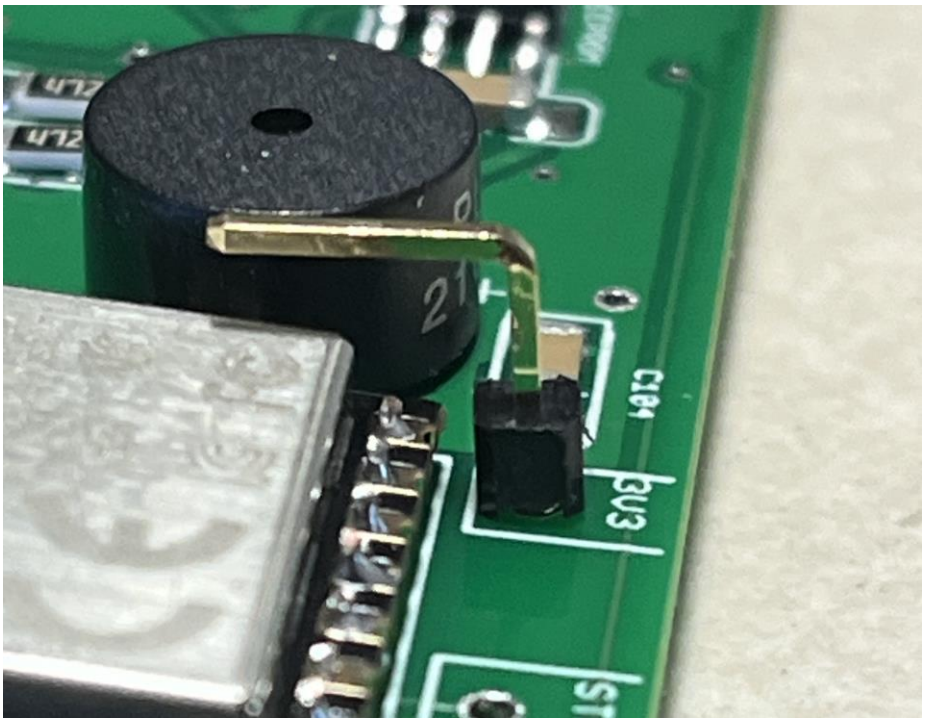
__ Mount the Header

With a pair of small diagonal cutters, cut one pin off the 4-pin right-angle header. Insert the 3-pin header from the top of the board so that the stubby side goes through the board, and faces inwards towards the center of the board. Hold it in place with some masking tape, turn the board over, and carefully solder the pins in using just enough solder to bond the pins to the pads. When you're done, bend the pins out slightly away from the metal "can" of the WiFi module… you do NOT want these pins contacting the metal can!



__ Mount the 3V3 Header (optional)

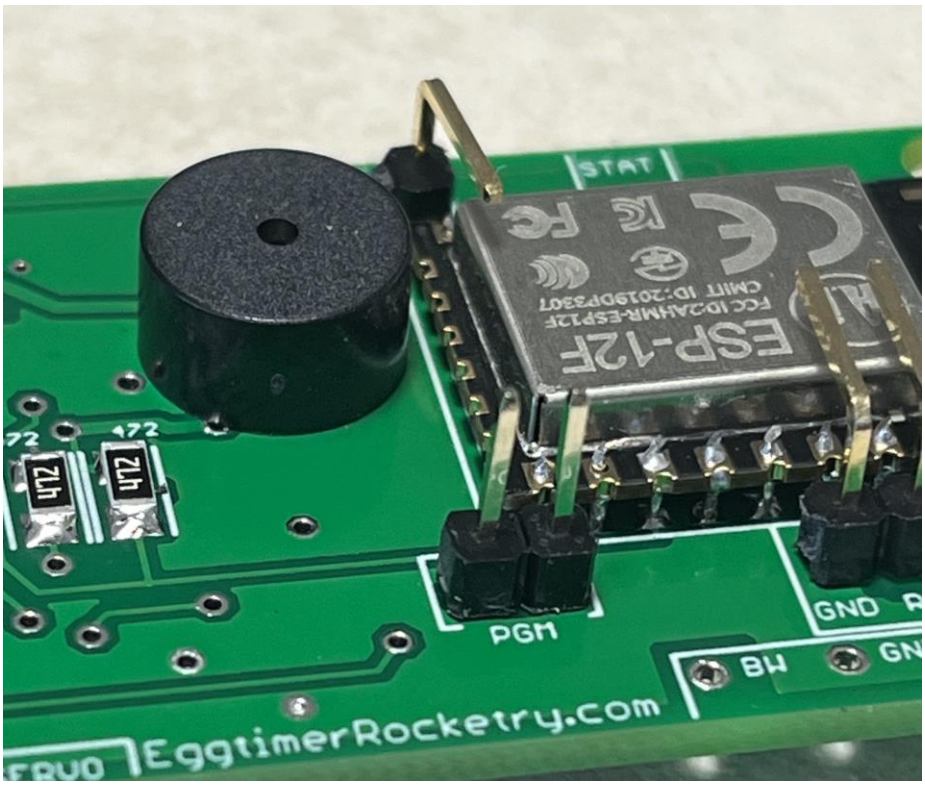
If you're going to use the Proton with an Eggtimer Telemetry Module, solder the remaining right-angle pin into the pad marked 3V3, so that the stubby side goes through the board, and faces inwards towards the center of the board. Hold it in place with some masking tape, turn the board over, and carefully solder the pins in using just enough solder to bond the pins to the pads. When you're done, bend the pins out slightly away from the metal "can" of the WiFi module… you do NOT want these pins contacting the metal can!



___ Mount the 2-pin header

Locate the spot marked “PGM” next to the 3-pin header. Insert the 2-pin header into that spot, so that the short end goes into the board and the long end faces up. Hold the header in place with some masking tape, then turn the board over and solder the pins in place.

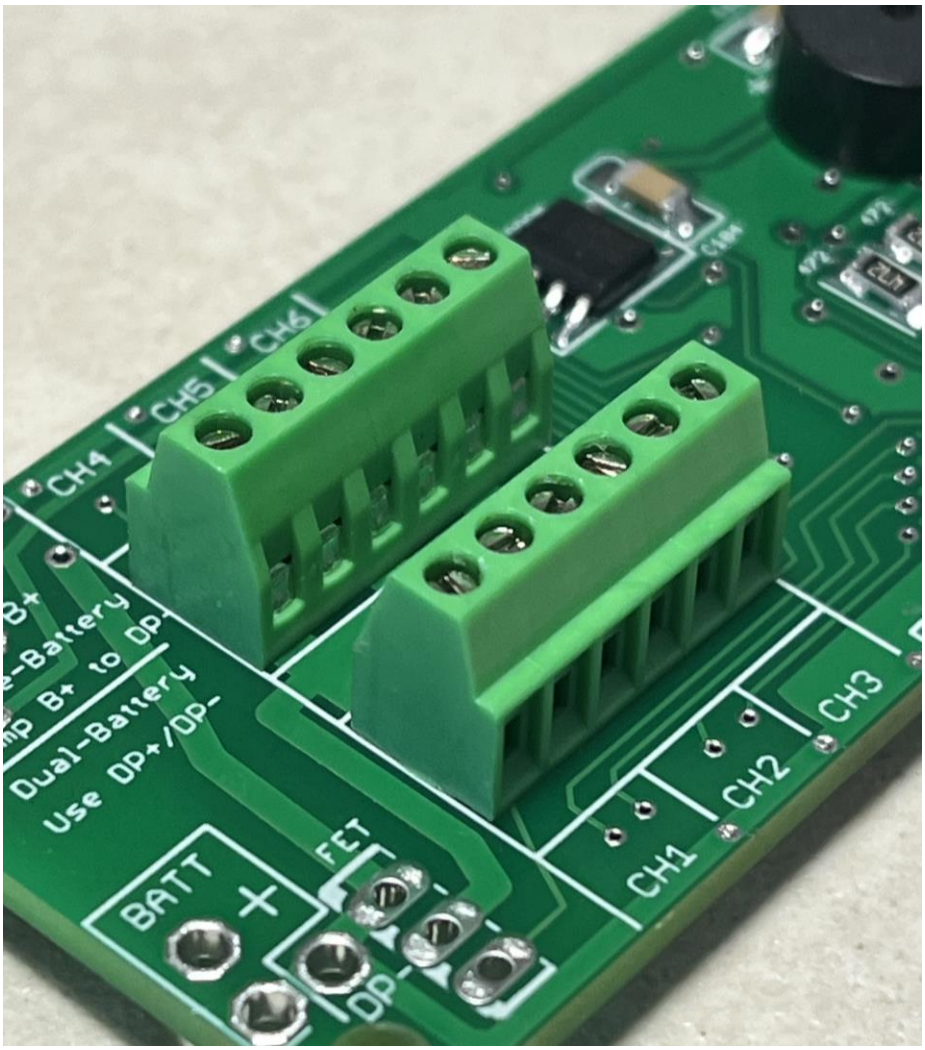
Note that you will NOT be using this header for anything in the normal operation of your Proton… it’s used to put your Proton into “bootloading” mode to upload new versions of the firmware. We’ve included a shorting jumper for this purpose, we recommend that you keep it in your range box with your other AV bay accessories.



__ Solder the Screw Terminal Blocks (Optional)

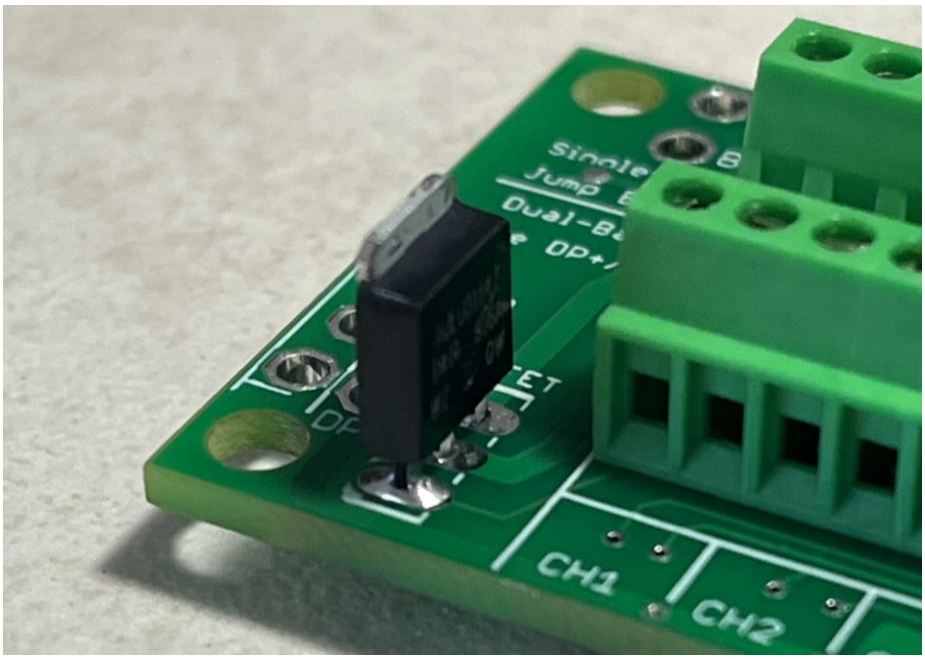
If you’re going to use them, insert the screw terminal blocks on the board, making sure that the open side is facing outwards towards the near edge of the board. Hold them in place with some masking tape to make sure that they're flat with the board, turn the board over and solder the pins to the pads. Be generous with the solder, you need a good mechanical connection here.

When you’re done soldering the pads for the terminal blocks, get out a 10x jeweler’s loupe and inspect the solder joints carefully… you do not want any of them shorting against adjacent pads! You should be able to see the space between the pads plainly… if you can not, use some desoldering wick and take off some solder.



__ Mount the MOSFET

Locate the MOSFET, it's a 3-pin part with a metal tab on one side. Depending on the part that is shipped, it may be marked "AULU3114Z" or "LU3636"; they are functionally identical. Locate the spot on the left side of the board marked "FET", you will see that the right side of the pads has a thicker bar marked on it. That is the marking for the metal tab side of the MOSFET. Be sure to orient it correctly; the tab should be facing to the right, TOWARDS the right edge of the board and AWAY from the screw terminals. Use some masking tape to temporarily hold it in place, then turn over the board and solder in place. Turn the board over and clip the leads flush.



Final Inspection….

Get out your lighted magnifier and carefully inspect all of the solder joints. Make sure that there are no solder bridges. If something doesn't look 100% right, resolder it, removing it first if you have to. We recommend using desoldering wick to remove any excess solder first before resoldering; it actually makes the resoldering task much easier, because you're not trying to heat up as much solder.

Congratulations, you're almost done! You just need to decide on the battery configuration and solder the pigtail(s) accordingly… read on.

About Deployment Output Power

The Proton allows you to use a single battery to power both the logic and the outputs, or you can use a separate battery for the outputs. Your choice will largely depend on what you are driving with your outputs. If you are going to be using standard ematches or PWM servos, the single battery option with a 2S Lipo battery is fine. (In the case of servos, you're probably going to use a separate battery for them anyway, but it doesn't connect to the Proton's outputs.) If you are going to be using a higher-voltage load such as a solenoid or hot-wire, you may want to use a separate battery for the output load and the Proton's logic. If you need to use a battery with a voltage higher than a 2S Lipo on your output load, you NEED to use a separate battery for your output load. The Proton's output drivers can handle up to a 6S/22.2 V LiPo battery.

However, for most purposes a single 2S Lipo battery will be sufficient. The Proton uses special current-limited driver chips instead of simple FET's, and the driver will also shut off if the input voltage goes too low, so if the current draw from your battery exceed the limit of the driver chips (about 10A each), the driver chips will shut off to protect your battery and the circuitry. This effectively protects the altimeter/processor side of the Proton from resetting due to low-voltage, which is why we don't need to have a humongous "keep alive" capacitor on board like some other altimeters do to prevent brownouts.

If you do decide on a single battery, we recommend that you make it big enough so that it can handle a short on your igniter for a few seconds without severely lowering the voltage output of the battery. Our general rule is that the battery's output current capability should be at least 5 times the all-fire current of your igniter, 10x would be better. For example, a 7.4V 350 mAH 20C battery can put out 20x 350 mAH, or about 7,000 mA (7A). If the all-fire current on your ematch is 1A, that's a 7x safety margin… plenty enough. In general, we also recommend that you don't fire the igniter any longer than you have to … 1 or 2 seconds is way more than enough for an ematch. Save the longer settings for a hot-wire cutter or something like that.

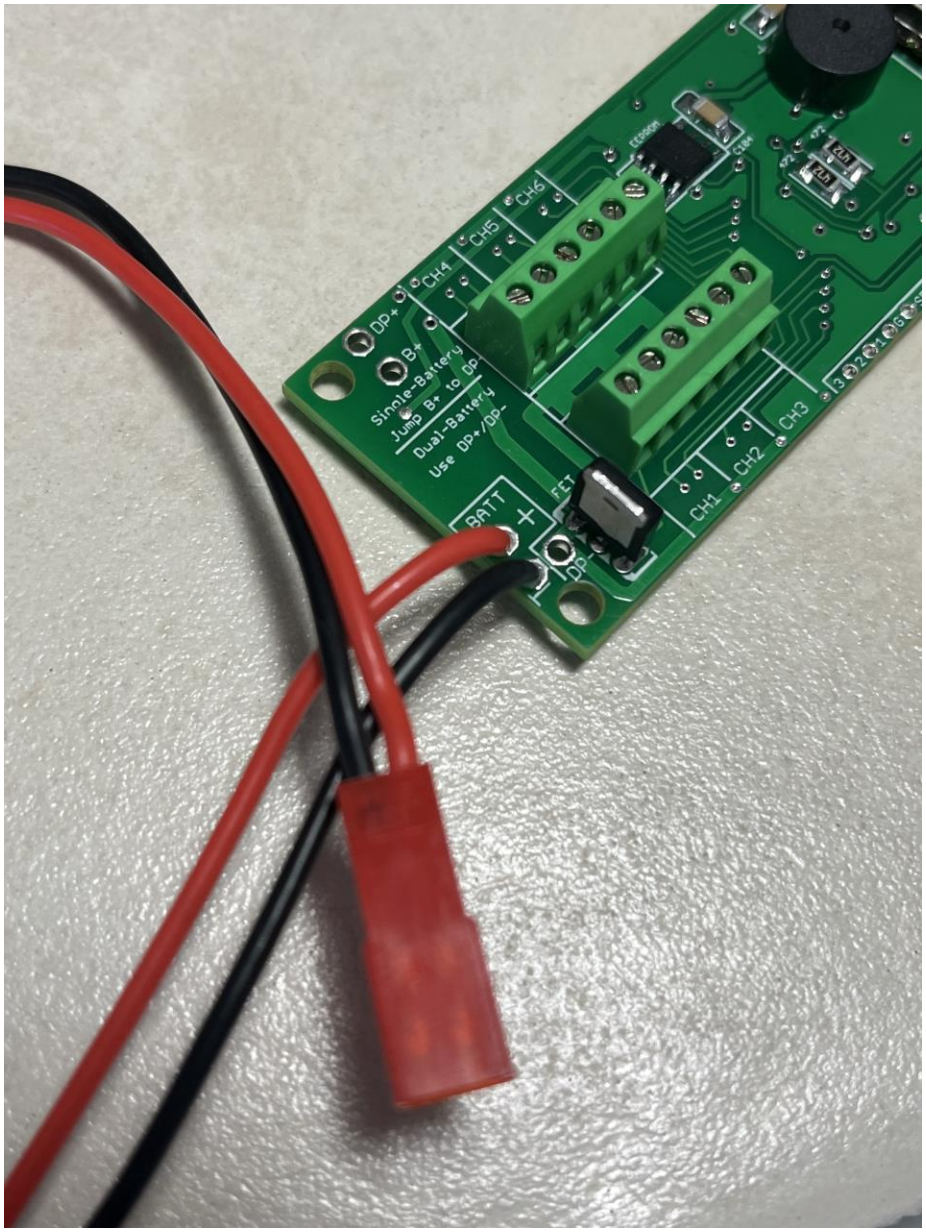
The Proton is different than almost every other altimeter that we're aware of in that it switches both sides of the deployment outputs. Other altimeters have one lead of the igniters tied to a common battery lead (usually but not always "+"), and the igniter is fired by closing a switch on the other lead (usually but not always "-") completing the circuit. The Proton incorporates a MOSFET switch on the deployment power as well as the typical on/off switching of the deployment drivers, so that the igniters are essentially "dead" until you are almost at apogee in flight. The only way you can fire an igniter on the ground is with the test web page, which you cannot get into from the normal Proton web pages. In addition, the Proton will not self-arm… if you turn it on with ematches connected it will just sit there with the deployment power turned off until you arm it with your wireless device using the proper validation code.

What this means is that there is an electronic switch on the deployment power, interrupting the circuit and essentially satisfying the NAR/TRA requirements for a switch disconnect on the deployment power until it's armed. You can connect your battery/batteries with confidence at your work table, knowing that there's no way to accidentally fire a deployment channel.

___ Solder your battery pigtail

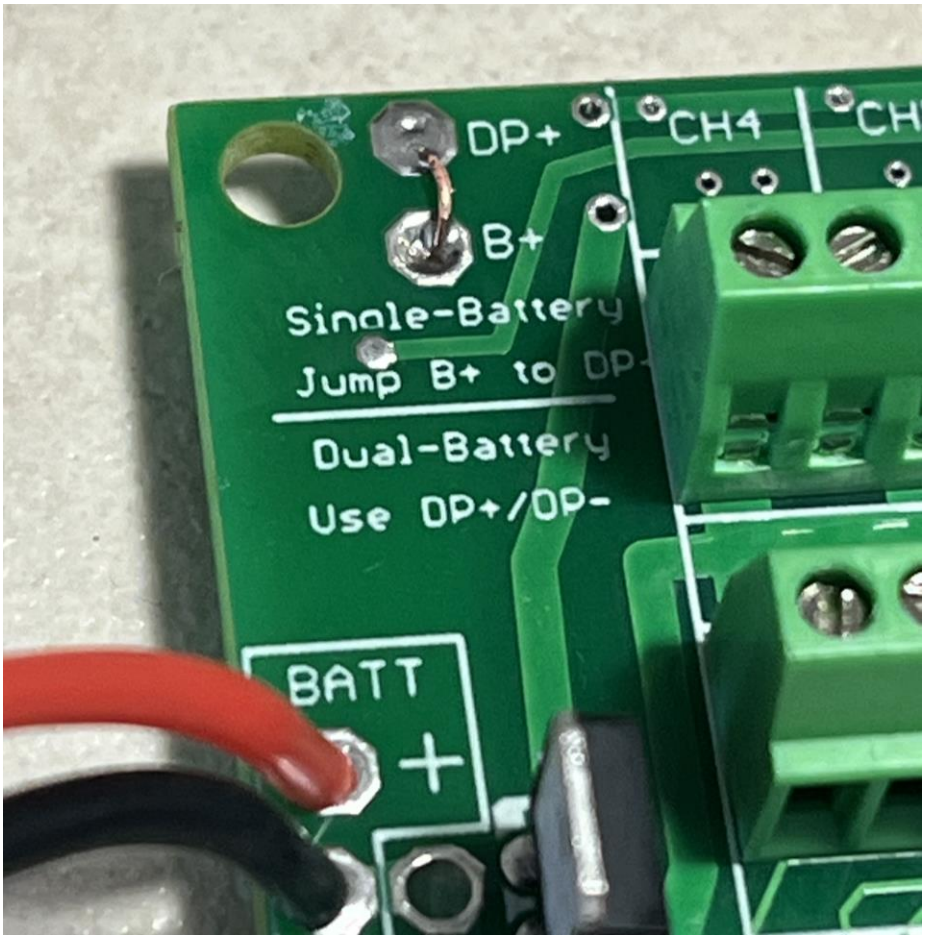
BEFORE you solder the battery connector to the board, use a DVM to confirm the "+" and "-" leads of your battery "pigtail". Usually, the "+" lead will be RED and the "-" lead will be BLACK; however, we have seen some that were colored differently, and we have also seen some that were mis-wired at the factory. Checking it before you solder the connector will ensure that it is soldered correctly.

Solder the "+" lead of your battery connector to the pad marked "BATT+", near the upper-right edge of the board. Clip any excess wire, and make sure that no stray wire strands are present. Solder the "-" lead of your battery pigtail to the pad marked "BATT-", next to the BATT+ pad. Clip any excess wire, and make sure that no stray wire strands are present.



For Single-Battery Operation

Solder a jumper between the two pads marked B+ and DP+, next to the lower-right edge of the board. Clip any excess wire, and make sure that no stray wire strands are present. We recommend using solid wire for this if you can… we have had good luck with an excess snippet of wire from an ematch.

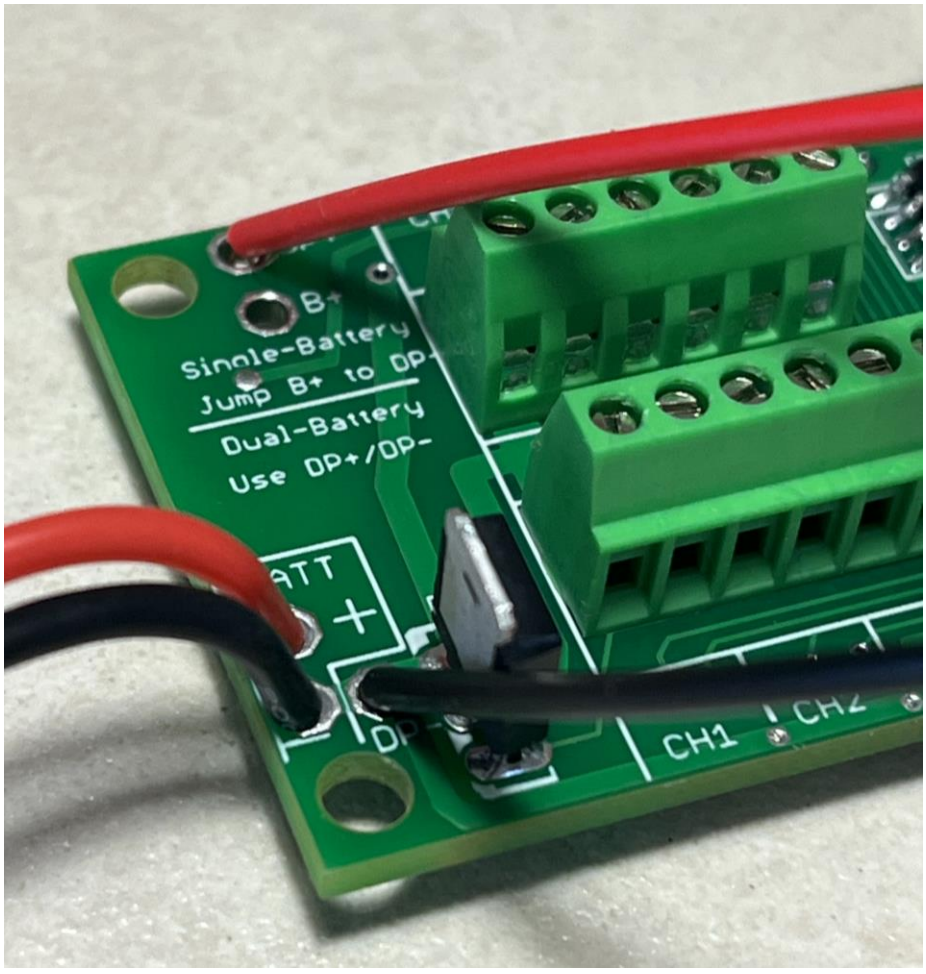


(Note that you can also use a switch between the B+ and DP+ pads, this is an excellent option for use with airstarts. We like to use pull-pin microswitches with airstarts, with a "Removed Before Flight" flag… Lab Rat Rocketry sells some very nice ones. You can read more about this in the Airstarts section of the Eggtimer Proton User's Guide.)

For Two-Battery Operation (Using a Separate Deployment Battery)

BEFORE you solder the deployment battery connector to the board, use a DVM to confirm the "+" and "-" leads of your battery "pigtail". Usually, the "+" lead will be RED and the "-" lead will be BLACK; however, we have seen some that were colored differently, and we have also seen some that were mis-wired at the factory. Checking it before you solder the connector will ensure that it is soldered correctly.

Solder the "+" lead of your deployment battery connector to the pad marked "DP+", near the lower-right edge of the board. Clip any excess wire, and make sure that no stray wire strands are present. Solder the "-" lead of your battery pigtail to the pad marked "DP-", next to the FET and the BATT- pad. Clip any excess wire, and make sure that no stray wire strands are present.



(Note that you can also use a switch in-series with a second deployment power battery, this is an excellent option for use with airstarts. We like to use pull-pin microswitches with airstarts, with a "Removed Before Flight" flag… Lab Rat Rocketry sells some very nice ones. You can read more about this in the Airstarts section of the Eggtimer Proton User's Guide.)

Preliminary Testing

This assumes that you have completed the board, including your battery pigtail(s) and any switches that you may have added. If you have not, go finish those first.

Connect your battery to the pigtail. You should hear three quick beeps, then a long one. If you do not hear any beeps, **immediately** disconnect the battery and go to the troubleshooting section. Chances are pretty good that you have a solder bridge or an incomplete joint, so the first thing you need to do is to examine the board thoroughly with a magnifying glass. About 99% of all the problems that we see are due to soldering issues.

The Proton acts like a WiFi access point and a server, you simply connect your WiFi-enabled device to it and browse to its home page, and voila! you get a web page that lets you turn your switch on and off.

Like any secured WiFi network, you need two things to connect… the SSID and the passkey. The SSID of your Proton will be "Proton_nnnnnn" where nnnn is the last 6 hexadecimal digits of your device's MAC address (a unique address given to every Ethernet device). The SSID is broadcast, so you should be able to see it in your device's WiFi manager.

The passkey is an eight-digit number generated by a random number algorithm the first time that your Proton is powered on, and is saved in EEPROM memory at that time. It's going to be unique for every Proton. There should be a label on the little baggie that the WiFi module came in with the passkey (you kept it, right?), but it's easy to get it if you lose it…

To recover the passkey, connect a USB-Serial cable (the same cable that's used with all Eggtimer Rocketry products) to the 3-pin header as follows:

BLACK wire – GND
WHITE wire – TX
GREEN wire – not used

Using an ASCII terminal program such as TeraTerm or PuTTY, connect to the serial port at 115,200 baud, 8 bits, no parity, 1 stop bit. Now connect the battery on your Proton. You should see the following information:

```
(a few lines of garbage… part of the boot process)

Proton v2.01a
SSID: Proton_F87A6E
PASSKEY:  3718 6501
```

Note that there is a space between the first four digits of the passkey and the second four digits, that's just to make it easier to read; when you actually enter the passkey don't type the space.

Disconnect the battery, and remove the serial cable. You won't need the cable again unless you forget the passkey, or you need to flash the software.

Now, fire up your device's WiFi manager. Connect the battery to your Proton… you'll hear the buzzer beep 3 times then stay on for a second, and in about 10-15 seconds you should see your Proton's SSID on your WiFi manager. Connect to the SSID using the passkey that you obtained earlier (but don't put the space between the digits!)

Now, connect to the Proton's Status Page with your WiFi browser in Private mode (Apple) or Incognito mode (Android), and in the address box enter:

http://192.168.4.1

Note: We recommend that you bookmark this URL, and use it to bring up the pages on your Proton. See the section in the Eggtimer Proton Users Guide about using the Proton with your phone's WiFi/browser… there are some tricks there that you may need to know. In particular, you should ALWAYS use Private/Incognito mode, to prevent pages from being cached.

…and you should see the Proton's status page.

The status page will show you several things…

o Arming status & arming code
o Channel status (mode, basic setting, continuity, settings links)
o AGL altitude
o G reading from vertical (zero is horizantal, +1 is vertical)
o Temperature
o Links to global settings, flight downloads

The thing that you want to check here is that you have a reasonably decent reading for your AGL altitude, i.e. if your elevation is 500' it should say 500 +/- a few percent. That verifies operation of the baro chip. Don't expect the temperature to be accurate when you first turn on your Quantum… it takes awhile for the sensor chip's internal thermometer to stabilize (typically 5-10 minutes). During an actual flight cycle this won't be an issue, just be aware of it for testing so you don't think something is broken.

The other thing you will probably note is that your G reading be "about" zero. It probably won't be exact, due to many factors, not the least of which is that the accelerometer will need to be calibrated (see the Eggtimer Proton User's Guide). Note that sometimes (not very often) the G reading will be about 1.0 instead of 0.0 when you power up; if you disconnect and reconnect the battery, it should be near zero again.

Testing Continuity and Outputs

Disconnect the battery (or batteries), and connect a suitable load to CH1. We recommend using miniature Christmas tree lights as test loads (the incandescent ones, NOT LED's.) You can get a string of 100 of them for a few bucks, you simply clip one off the string, strip and tin the leads, and connect it to the terminal blocks. BTW, the terminal blocks are shipped CLOSED; you will need to unscrew them first before you use them.

WARNING: After assembling your Proton, you should test EACH channel with a non-pyrotechic load such as a Christmas tree light bulb BEFORE you connect a pyro load to it. Be VERY careful when doing any testing using ematches, especially if it's the first time that you've connected a load… if you have a short somewhere it could fire as soon as you connect the battery. DO NOT test with a "live" pyro charge such as a black powder charge, until you are 100% confident in the channel's operation, and when you do test with live pyro charge you should be at least 10' away. While the Proton has several hardware and software safety features to prevent unintended triggering, a short in the circuit board somewhere cannot be anticipated ahead of time!

Now, set your browser to the Status Page (you did bookmark it, didn't you?)…

You should see that the mode of CH1 is "OFF". Click on the "Change" link next to the "OFF" mode, and in the Mode screen change it to "Drogue", then click Submit. Your status screen will come back, and the CH1 mode should be "Drogue", and the continuity indicator should be "ON" in TEAL. That means that it has continuity and is ready for arming. If the continuity indicator is in RED, that means that you don't have continuity… check your connections.

To test the output with the Christmas tree light on CH1, set your browser to

http://192.168.4.1/test

Select "Channel 1" from the drop-down screen, enter the displayed arming code into the text box, then click on the TEST button. You will see a count-down from 5, then the light should come on for approximately two seconds.

After confirming that Channel 1 is working, disconnect the battery, and repeat the procedure for the other channels until all six have been tested. If one of them is not working, go to the Troubleshooting section at the end of this guide and go through the list.

At this point, your Proton should be 100% functional. If you have not done so already, download the Eggtimer Proton User's Guide, and start reading through it. (Yes, it's pretty large… the Proton does a lot of stuff) At the very least, go to the Quick Reference Guide at the end of the User's Guide, it should give you an outline of what the screens do and what you can do with the various options in them.

Have fun, be safe, and enjoy your Eggtimer Proton!

Mounting the Proton in Your AV Bay

The Proton has four #4 holes for mounting in a AV bay sled. It's about 3.25" x 1.25" x 3/8", so you'll need to make sure that you have enough room on your sled for it. You **MUST** mount it so that the WiFi module is facing "up", i.e. the "UP" markings and the arrows are facing your nose cone. There's a drilling template on the Eggtimer Rocketry web site, we recommend that you download it, print it, and cut it out with scissors so you can drill the mounting holes accurately. Note that it is **VERY** important that you mount your Proton as vertically as possible, for the most accurate readings... if it's a bit crooked, your accelerometer readings will be off by about 1% for every degree from vertical.

Our favorite mounting method is to use four #4 hex-head cap screws, about 3/4" long, with one #4 nylon washer between the head and the top of the board and three #4 nylon washers to act as a spacer between the bottom of the PC board and the sled. We hold it on with nylon-insert nuts… they don't work loose. If you mount it like this, you can pretty much use whatever monster motor you may have on-hand (like the infamous O5800, for example) without fear of anything coming loose.

Alternatively, you can use all #4 Nylon hardware, then you don't have to worry about the insulating washers.

Be sure to have an adequate spacer between the bottom of the PC board and your sled, components should NOT be resting against the bottom of your sled. Also, be careful not to overtighten any screws that you use. It's possible to bend the PC board if you overtighten them, doing that may break solder joints or even a lead on an IC if it's forced against the sled. Don't ask us how we know this..

We generally recommend that you try to mount the Proton as close to the battery and your altimeter as possible, and keep the wiring as short as possible. Small zip ties work really well for tidying up the wires. Also, we **strongly** recommend that you zip tie the wires connected to the Proton to your sled, to provide strain relief for them. In general, if a wire can't move, it won't come loose. Enough said…

Note that large bits of metal in your AV bay will reduce the WiFi range of your Proton, as will metallic paint or carbon fiber body tubes. In most cases, the range will be good enough for you to be able to operate the Proton from a reasonable distance close to the rocket, maybe 10'-20', but you need to be aware of this in case you're thinking that you can arm your 75mm minimum-diameter carbon fiber machbuster sitting on the away pad from the LCO's table… it ain't gonna happen.

About Batteries for Your Proton…

The Eggtimer Proton was designed with 2S/7.4V LiPo batteries in mind. The Proton uses about 85 mA of current, so we recommend that you use a battery with at least 300 mAH of capacity. That will give you about 3 hours of power, which should be enough for almost all flights. Bigger is better. You CAN use a smaller LiPo battery, just remember that the run-time will be less, so if you put a 200 mAH battery in your AV bay and it sits on the pad for two

hours, you may have an unpleasant surprise if your battery runs down before your flight. Fortunately, it's easy to monitor the battery voltage of your Proton, so this shouldn't happen.

Regarding the battery voltage monitor, we recommend that if you're using a LiPo battery you don't fly if the battery voltage registers under 3.5V per cell, i.e. 7.0V for a 2S LiPo. 3.7V is the nominal rated output voltage, but the reality is that a fully-charged LiPo cell will read 4.2V or near. That's a lot of leeway, so if it's already drained down that far before you fly it may end up going dead (below 3.0V) if you have to spend a lot of time looking for your rocket. As always, the best policy is to charge your batteries completely before each flight, and/or use a fresh battery.

Note: We strongly recommend that you do NOT use a 9V alkaline battery with your Proton. Most 9V alkaline batteries are only good for 100 mAH, so you may get less than 60 minutes of use out of one. We realize that they ARE easy to get and they ARE convenient because you don't have to mess with charging them, but having an expensive rocket lawn-dart into the ground because of a weak battery is not something we like to see.

If you are using stranded wire, you may want to tin just the very end of the wires to prevent them from fraying; a loose strand of wire can short out the battery, which can cause a fire if you're using LiPo batteries, so check your connections carefully to make sure that there are no shorts. Better yet, use crimp-type ferrules… with the proper crimp tool (no, pliers will not work!)

For a flight, we strongly recommend that you zip-tie any and all connections to the sled next to the pads/terminals. This prevents wires from pulling out of the screw terminals due to G forces. Similarly, you should tape closed any connectors, and zip-tie any loose wires to the sled. If it can't move, it can't come loose…

Troubleshooting

If your Eggtimer Proton doesn't work after assembly and testing, take a deep breath, get out a beverage to clear you mind, and start troubleshooting…

Check Your Solder Joints

The very first thing you should do is to check out all of the solder joints under a lighted magnifier, or with a 10x jeweler's loupe or magnifier, and make sure that all of the parts are in the right place. The most common reason for things not working are solder bridges, i.e. putting too much solder on the pads and shorting two adjacent pads together. You can also get into problems by bridging pads with "vias" on the board, the smaller holes that don't have any components soldered to them. Most of the holes and the pads are very small, so it doesn't take much solder to get a nice "tented" solder joint. If you get a solder bridge, heat it up and use a solder wick or a vacuum bulb to remove the excess; afterwards, we recommend resoldering the joints. Note: NEVER use "canned air" or compressed air to "blow away" excess solder. The resulting solder splatter will almost always cause more damage than the original solder bridge. "Canned air" is actually a refrigerant, and the cold shock can damage electronic components.

Another thing to look out for is "cold" solder joints, they look dull and blobby compared to a nice shiny "tented" solder joint. Cold solder joints won't conduct well; at the low power that the Proton uses this could easily keep things from working. If you have a cold solder joint, heat it up and put just a little bit of solder on it, the main idea is to get a little more flux on the joint. If there's too much solder, use a fine solder wick or a vacuum bulb to remove the excess, then heat it up and resolder the joint.

Check Your Component Polarity

There are a number of small chips on the Proton's board, and if you mount any one of them backwards it can cause unpredictable and undesirable effects. You need to inspect all of the parts carefully BEFORE you power it up…

Most of the small components aren't polarized, with some notable exceptions. The outline of the parts is silk-screened on the board, so you should be able to see readily if you have a component soldered in backwards. Some of the components are not symmetrical (i.e. the voltage regulators) so they would be difficult to install backwards, too.

If you inserted a component incorrectly, you will have to carefully unsolder it, clear any solder residue from the holes, and resolder it. If you find that a component was soldered incorrectly, you will have to use a vacuum bulb or vacuum desoldering tool to unsolder it. We cannot stress enough that you need to check the orientation of the parts ***before*** you solder them. The Eggtimer Proton Limited Warranty does not cover damage to a component while attempting to unsolder it, so make take your time and make sure you get it right before you solder.

If It Still Doesn't Work…

There is, of course, always an outside chance that you have a bad component. We pre-program and test every WiFi module, and the other parts are factory-direct so the likelihood that one of them is bad is very small. Nevertheless, it is always possible that something may be wrong; there may be a bridge on the PC board itself, etc. If you have gone through all of the troubleshooting steps and the board still doesn't work, let us know at support@eggtimerrocketry.com . A high-resolution picture (5 megapixel or better) of both sides of your circuit board and a description of the problem would be very helpful…

Troubleshooting Tips (in approximate order of likelihood)

No power-on beeps when you connect the battery

- Battery polarity backwards
- Bad solder joint on voltage regulator
- Bad solder joint on rectifier
- Bad solder joint on 10 uF capacitors
- Bad solder joint on the ESP8266-12 module
- Buzzer on backwards
- Bad solder joint on SI2302 FET or 103 resistor above it
- Other component backwards (driver chip, memory chip, etc.)
- Weak battery (Use a freshly-charged 2S/7.4V LiPo battery)

No data when I connect the USB-Serial cable

- Serial cable connected incorrectly
- Terminal program not configured correctly
  (should be 115,200 baud, 8 bits, no parity, 1 stop bit)
- Bad solder joint on ESP8266-12 module
- Bad solder joint on header

Don't see a "Proton_…" SSID

- Bad solder joint on ESP8266-12 module
- Weak battery (Use a freshly-charged 2S/7.4V LiPo battery)

Can't connect to "Proton…" SSID

- Bad passkey (hook up the serial cable and check it)
- Wrong type/encryption selected
  (set them all to "auto" and let your WiFi manager pick it up)

Can't bring up Proton web page

- Bad WiFi connection (check your WiFi manager)
- Incorrect URL (use **http://192.168.4.1** in Private/Incognito mode)
- Weak battery (Use a freshly-charged 2S/7.4V LiPo battery)
- Bad solder joint on the ESP8266-12 module
- Problem with the two 4.7K resistors next to the baro sensor
- CAT25M01 EEPROM mounted incorrectly
- Browser setting issue (try using the "private"/"incognito" mode on your browser)

Channel continuity won't work

- Bad solder joint on the ESP8266-12 module
- Bad solder joint on the driver chip (#1 reason!)
- Reversed driver chip
- Bad solder joint on 104 the resistors around the drivers
- Bad solder joint on 472 the resistor around the drivers
- Weak battery (Use a freshly-charged 2S/7.4V LiPo battery)
- No deployment power

(Is the Deployment Power showing "ON" in the status page?)

Channels won't fire when I do a test

- Bad solder joint on the ESP8266-12 module
- Bad solder joint on the drivers (#1 reason!)
- Bad solder joint on the 104 resistors around the drivers
- Reversed driver chip
- Bad solder joint and/or reversed Power MOSFET
- Weak battery (Use a freshly-charged 2S/7.4V LiPo battery)
- No deployment power

(Is the Deployment Power showing "ON" in the status page?)

Eggtimer Proton Limited Warranty

Eggtimer Rocketry warrants that all of the parts listed in the parts list necessary to build the Eggtimer Proton are included in the kit, and that they are all new and working. We don't use surplus parts… we like stuff that we know will work. If you open up the package and find that something is missing, send us an email to support@eggtimerrocketry.com letting us know, and we'll get it taken care of right away.

Eggtimer Rocketry warrants that when constructed per the documented assembly procedure the Eggtimer Proton will perform substantially per the instructions. We try very hard to make sure that our stuff works the way we say it does, but because software isn't perfect we can't always anticipate things that may occur. If we find that there is a problem that prevents the Proton from operating as documented, we'll do our best to fix it in a timely manner.

Since there is a wide variation of possible configurations using the Eggtimer Proton and there is no way that we could possibly test them all, we do not warrant the suitability of the Eggtimer Proton for any particular purpose. Hobby Rocketry is just that…a hobby. It's up to you to decide how to use our products, and whether or not they are suitable for your projects.