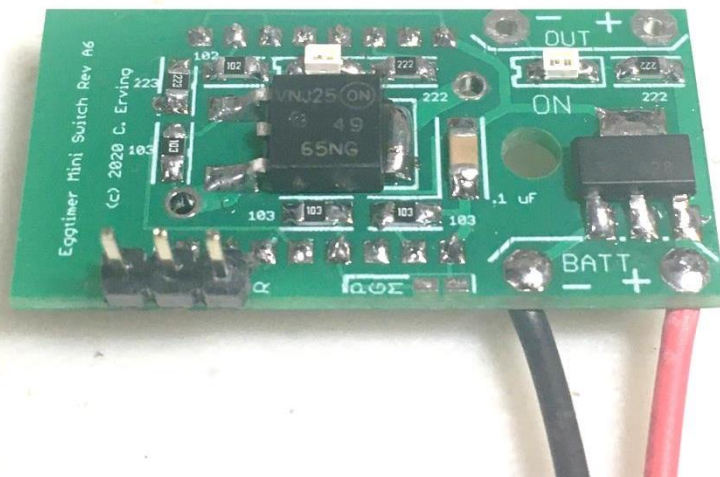


# Eggtimer Mini Switch Assembly and Users Manual

## Rev A6/A7



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## 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.

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This kit includes a special low-temperature ultra-fine leaded solder wire. Including the solder with the kit ensures that you will have solder that can be used to 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 MSDS can be found at

<http://www.kester.com/download/245%20FluxCored%20Wire%20Lead%20Alloy%20SDS.pdf>

## 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: 2ADUIESP-12 or ESP8266MOD**

The Eggtimer Mini Switch uses an ESP8266-12 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 Mini Switch 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 Mini Switch is unlikely to be significantly affected by outside radio sources, but there's no guarantee.

If your Eggtimer Mini Switch 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 cordless phones, WiFi and Bluetooth® devices, and garage door openers.

### **Important Links:**

FCC Part 15 (governing unlicensed intentional and unintentional emitters)  
<http://www.ecfr.gov/cgi-bin/text-idx?SID=adb12f74b498e43ec453f7899d9df0fd&node=47:1.0.1.1.16&rgn=div5>

FAA Regulations for Amateur Rocketry (Part 101)  
<http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&rgn=div5&view=text&node=14:2.0.1.3.15&idno=14>

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## **Before You Start...**

- Go to our web site at [www.Eggtimerrocketry.com](http://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 Mini Switch! This is the answer to a problem that has bugged many of us electronic deployment users for a long time... How do you turn on (and off) the power to your electronics without opening up the AV bay? There have been all kinds of switches, both mechanical and electronic, used in hobby rocketry, but they all have involved having to reach into a hole in the AV bay or put something like a magnet very close to it in order to turn on the switch. More than once we've had to take a rocket off the rail because we couldn't reach the power switch inside the AV bay...

The Mini Switch allows you to turn on (and off) your electronics using any WiFi-enabled browser device, such as a smartphone, tablet, or laptop computer. In addition, you can monitor the battery voltage as well. You can do all of this from up to 100' away from your rocket. Each Mini Switch has a unique WiFi SSID code, and it uses WPA2-PSK and AES encryption with a unique passkey, so it's almost impossible for anyone except yourself to connect to your Mini Switch and turn it on (or off!). To turn your electronics on or off you need to enter a 4-digit validation code that changes every 60 seconds or whenever you refresh the web page. This prevents the switch from being toggled if you put the phone in you pocket... you wouldn't want to "pocket dial" your altimeter!

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 Mini Switch...**

Assembling your Mini Switch 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!

The Mini Switch uses a number of Surface Mount Technology (SMT) parts, they 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 Home Depot... 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 Mini Switch, 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. We recommend that you start with a temperature of 680F; if you find the solder is sticking, turn the temperature up 20F, if you find that it's "popping" when you go to solder, turn it down 20F.

## **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
- \_\_\_ 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 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)

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 Mini Switch, deviating from them isn't going to make your life any easier.

We strongly recommend that you consult the assembly pictures on the Eggtimer Rocketry web site, [www.EggtimerRocketry.com](http://www.EggtimerRocketry.com) . Go to Support/Eggtimer Mini Switch.

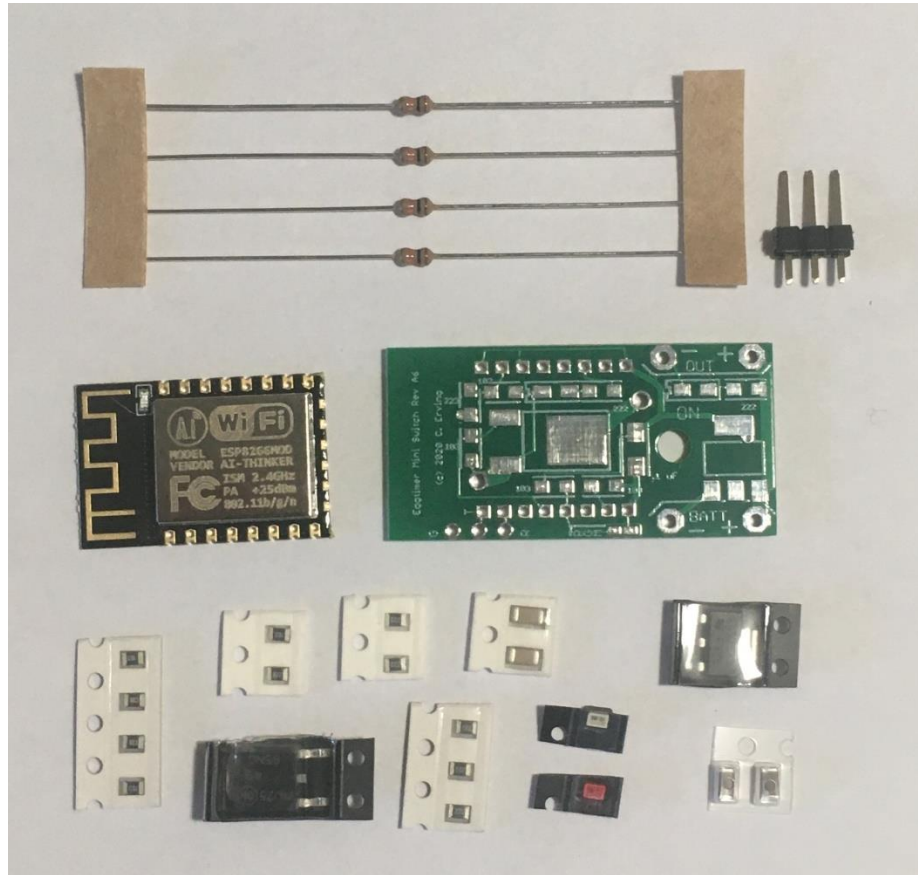
Each step is pictured, so you can see exactly what you need to be soldering. Looking at the pictures as you go will help prevent you from soldering the wrong thing, or putting something in the wrong way.

# Assembling your Mini Switch

## Step 1: 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...

<u>Qty</u>	<u>Description</u>
— 1	Circuit board
— 1	Pre-programmed ESP8266-12 WiFi Module
— 1	LD1117-33 or LDL1117S-33 3.3V voltage regulator (SOT-223 package)
— 1	NTD4965NT4G or NVD5490NLT4G MOSFET (Larger package with 3 leads)
— 1	0805 Red LED (package has a red stripe)
— 1	0805 Amber LED
— 1	1K 0805 resistor (marked “102”)
— 2	2.2K 0805 resistor (marked “222”)
— 3	10K 0805 resistors (marked “103”)
— 1	22K 0805 resistor (marked “223”)
— 1	.1 uF 1206 ceramic multilayer capacitor (brown) (not marked, but it’s in a PAPER carrier)
— 2	Rev A6 - 10 uF 1206 ceramic multilayer capacitors (brown) (not marked, but they’re in a CLEAR PLASTIC carrier)
— 1	Rev A7 - 1 uF 1206 ceramic multilayer capacitors (brown) (not marked, but they’re in a CLEAR PLASTIC carrier with a BLACK stripe)
— 1	Rev A7 – 4.7 uF 1206 ceramic multilayer capacitors (brown) (not marked, but they’re in a CLEAR PLASTIC carrier with a GREEN stripe)
— 4	1/8W resistors (value not important... we’re using them for the leads)
— 1	3-pin header



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 Mini Switch 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 Mini Switch, 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 Mini Switch 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 lighting up (LEDs) 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 Mini Switch Limited Warranty does not cover incorrect assembly***, so if you mess up badly enough you may end up having to get another kit and start over; neither of us want that.



It is very important that you assemble the Mini Switch 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 some 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](mailto:support@eggtimerrocketry.com), **BEFORE** you start building. We generally answer all questions the same day, and we do our best to ensure your success.

## Eggtimer Mini Switch Assembly Checklist

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](mailto: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 Mini Switch 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@eggtimerrocketry.com](mailto:support@eggtimerrocketry.com) *before* you solder.

### **About soldering the SMT parts**

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. 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.

Note that it is VERY important that the parts are "square" on the pads... some of them are very close together, and if they are crooked they might contact other parts on the board or short against another pad. They also need to be centered in the middle of the "footprint" for the part, if it's too far one way or another then it may be possible to create a solder bridge when you solder the pads. If you slide the part on and it's not quite square, don't be afraid to heat up the joint again and correct it... it will be a lot easier to fix it now than to unsolder it completely later to fix it, and it will be MUCH easier than trying to find where your solder bridge is later on!

After you've soldered the part in place, inspect the joints carefully with a 10x jeweler's loupe. You should see good solder coverage on the pads 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 20F 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.

## Mounting the TOP-Mount Parts

There are parts mounted on both sides of the Mini Switch board, this is done to save space. It does make the assembly task a little bit more complicated, but most of the parts are mounted on the “top” side of the board (i.e. the side that you see when it’s mounted in your AV bay). We’re going to mount the stuff on the top first, when we’re done we’ll turn it over and mount the stuff on the bottom side. All of the parts on the top side of the board are surface-mount, so we recommend that you tape the board to your work table first to make it a little bit easier.

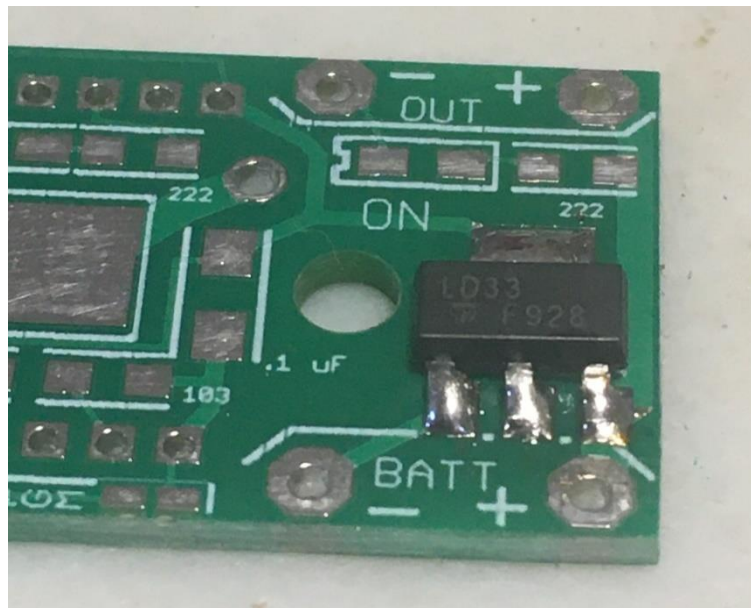
### — Orient the board

Tape the board down to your work surface with masking tape, on the extreme left side so you don’t cover any of the pads. The left side should be the side with the Eggtimer Mini Switch logo, the right side should be where the mounting hole is.

### — Mount the 3.3V Voltage Regulator

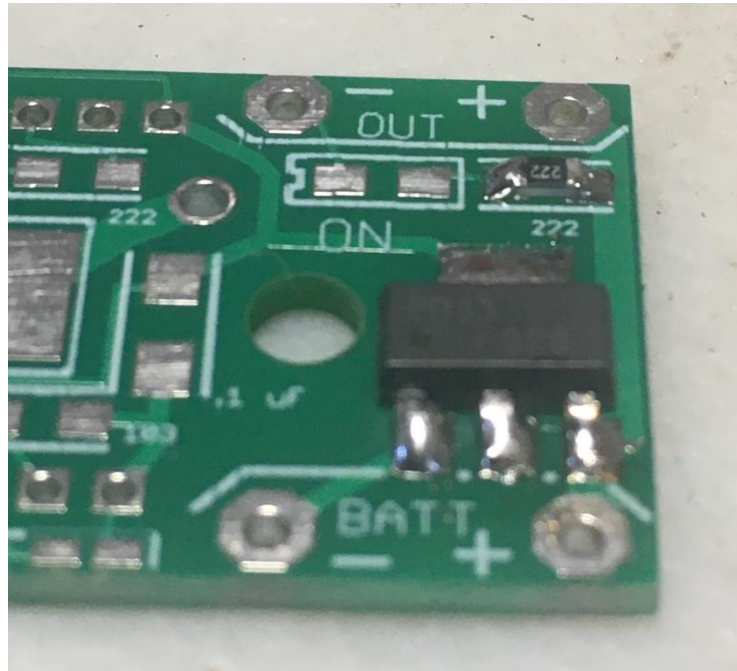
Locate the large pad and the three small pads for the voltage regulator. Heat up the large pad with your soldering iron and melt a small amount of solder on the large pad, just enough to cover it. Place the voltage regulator IC in place, and hold it down, then heat up the large tab on the voltage regulator 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.

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.



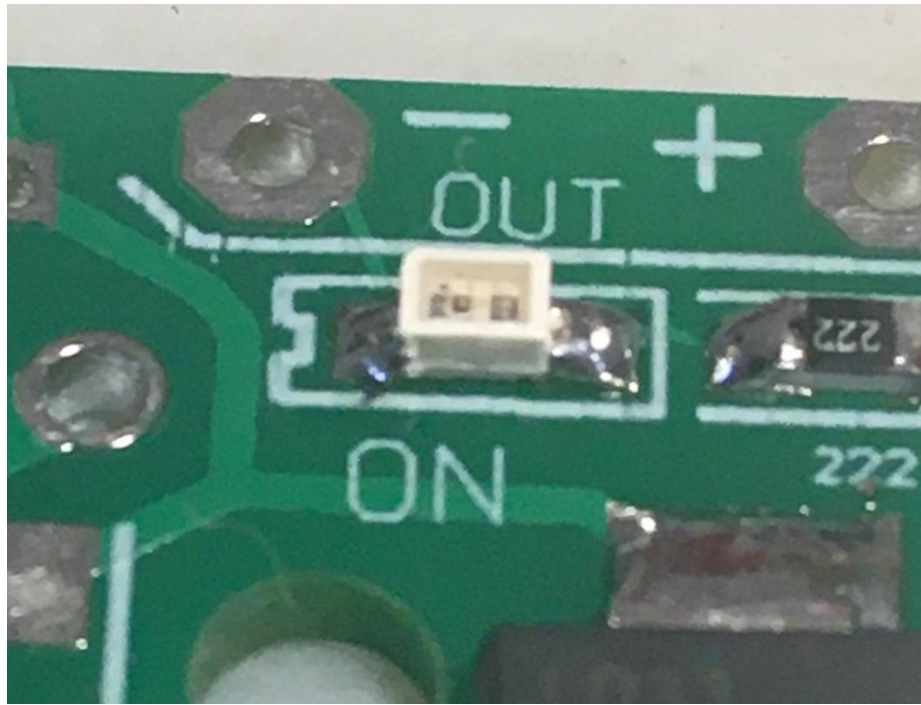
— Mount the 2.2K resistor

Locate the 2.2K resistor (marked “222”) just above the regulator. Solder it in place.



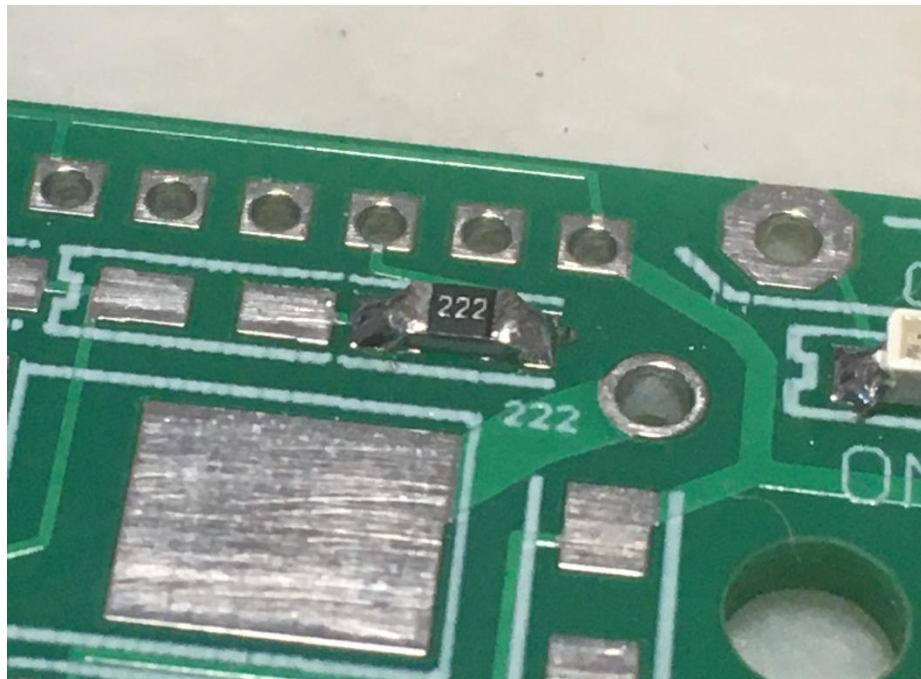
— Mount the Red LED

Locate the spot for the red LED, just to the left of the 2.2K resistor that you just soldered. Note that the silkscreen symbol on the PC board has a notch on the left side. The LED has a notch cut out of one corner, this needs to match up with the notch on the board... if you put it in backwards it won't work. You may need a 10x jeweler's loupe to see it... yes, this part is very small. Another thing you can look at is the location of the small “square” inside the LED... that's the side with the notch. The two LED's may come in nearly identical packages... the red LED has a red stripe marked on the package so you can tell them apart. Solder the LED in place. Note that the right pad is right up against the left pad on the 2.2K resistor... that is by design, they are connected to each other.



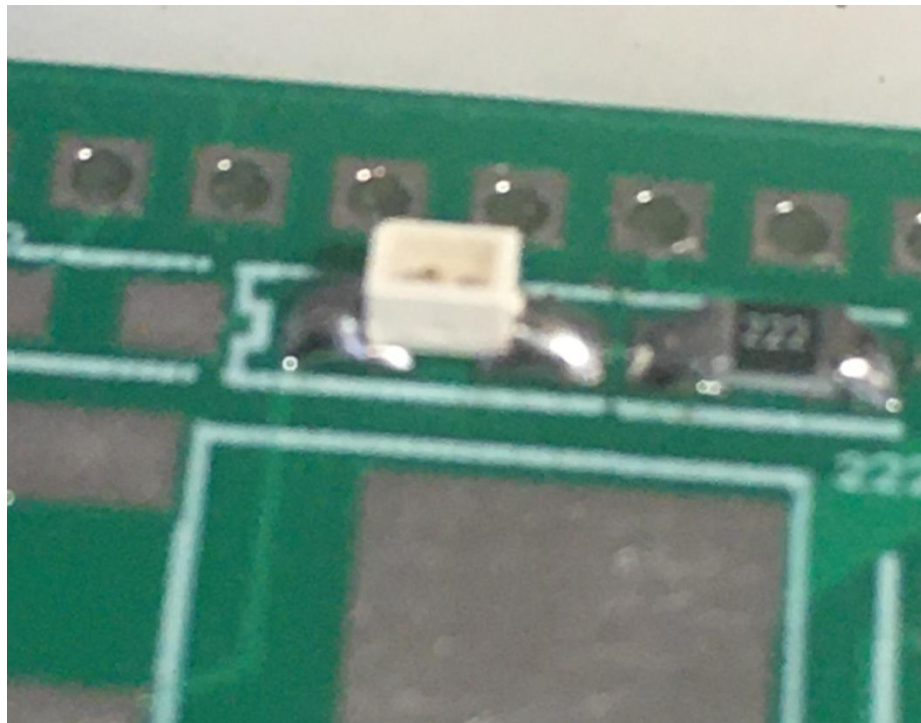
— Mount the 2.2K resistor

Locate the 2.2K resistor (marked “222”) about ¼” to the left of the red LED. Solder it in place.



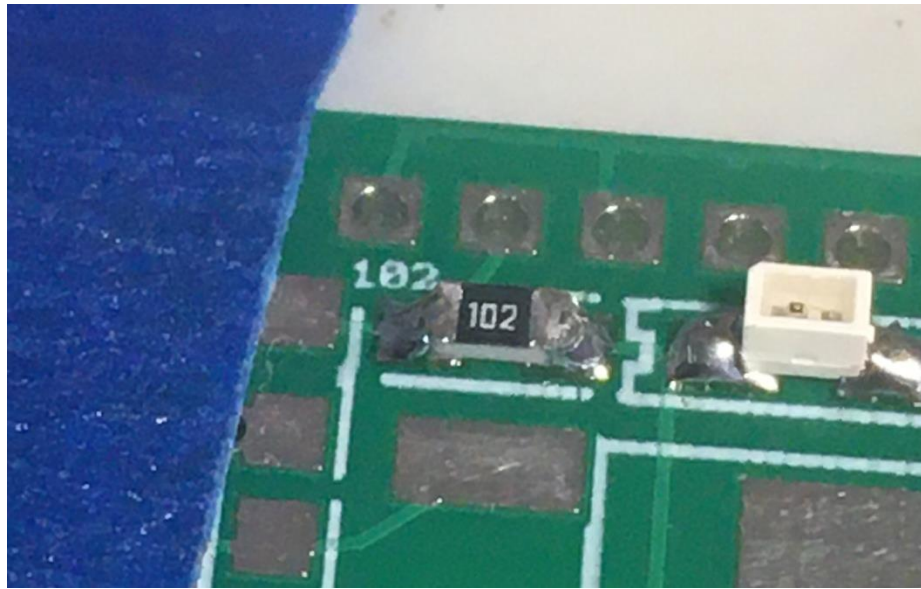
— Mount the Amber LED

Locate the spot for the amber LED, just to the left of the 2.2K resistor that you just soldered. Note that the silkscreen symbol on the PC board has a notch on the left side. The LED has a notch cut out of one corner, this needs to match up with the notch on the board... if you put it in backwards it won't work. You may need a 10x jeweler's loupe to see it... yes, this part is very small. Another thing you can look at is the location of the small "square" inside the LED... that's the side with the notch. Solder the LED in place. Note that the right pad is right next to the left pad on the 2.2K resistor... that is by design, they are connected to each other.



— Mount the 1K resistor

Locate the 1K resistor (marked "102") just to the left of the amber LED. Solder it in place.

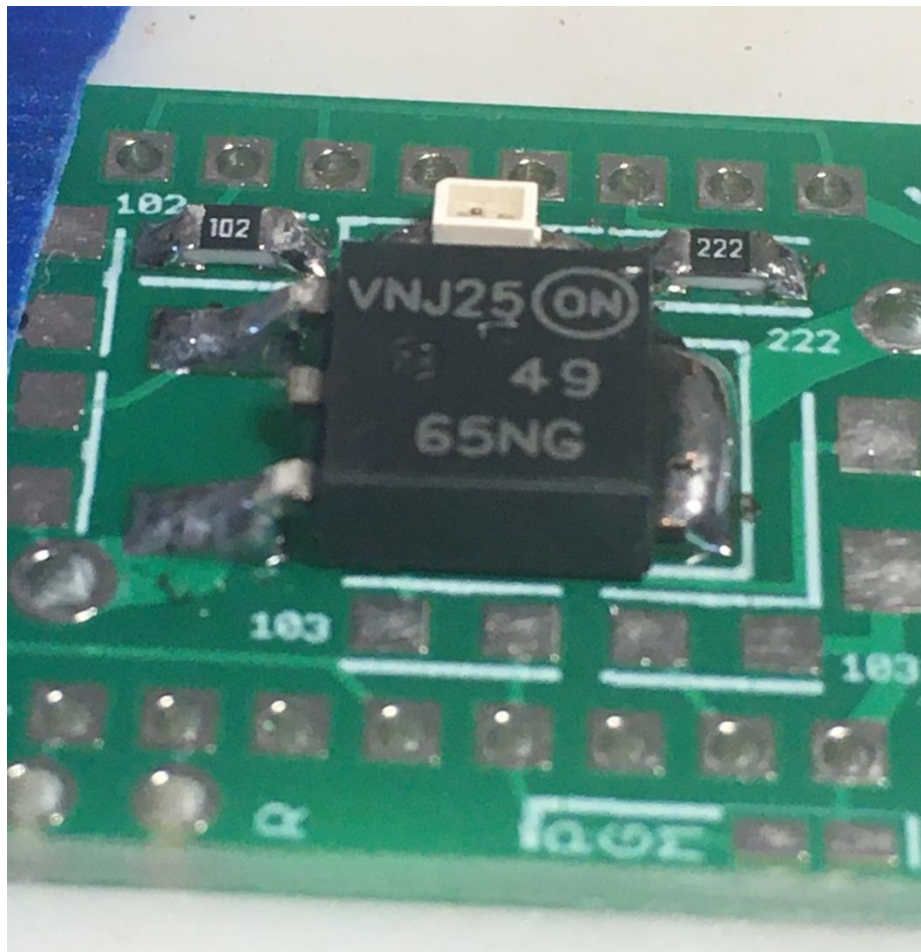


### — Mount the MOSFET

Locate the spot for the MOSFET, it's just below the parts that you just soldered. Very carefully remove the MOSFET from its package

Lightly tin the large pad nearest to the right side of the board. With tweezers, hold the MOSFET in place, centering it over the pad. If you have it right, the two leads on the other side should just sit on the opposing pads. Heat up the lead over the tinned pad until the solder starts to flow onto the lead, wait a few more seconds, then remove the iron and let it cool for at least 5 seconds before you let it go. Note that this is a big pad, so it may take several seconds to get enough heat into the pad to melt the solder.

Inspect the alignment of the MOSFET, making sure that the other two leads are sitting on their pads. Once you are satisfied, solder the smaller leads to the pads. Afterwards, check the solder joint on the large pad, and heat it up and add more solder if necessary.



— Mount the 10K resistors

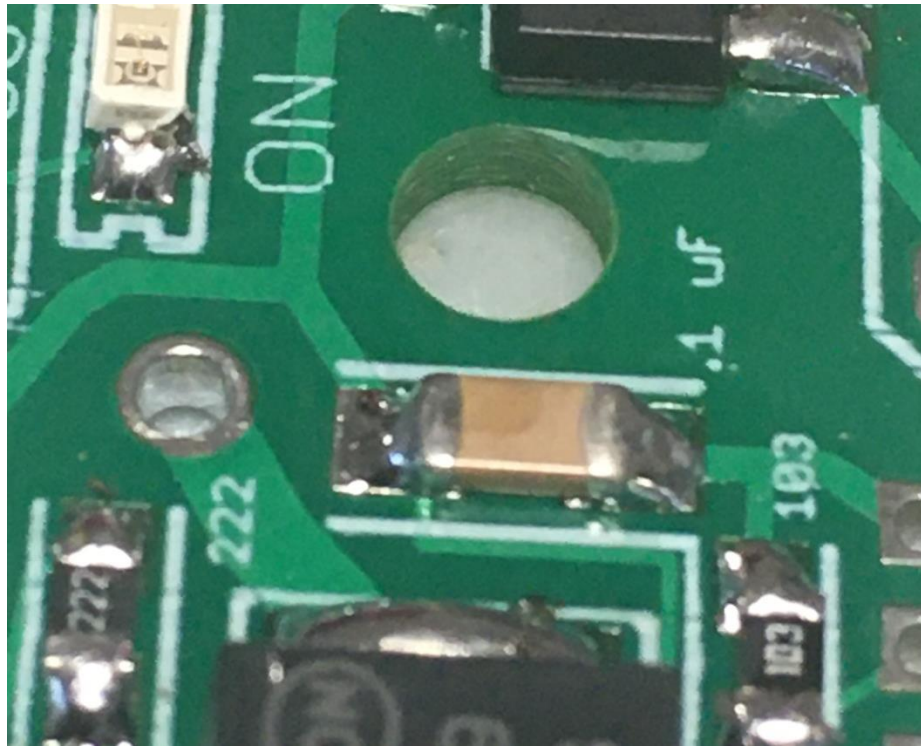
Locate the two 10K resistors (marked “103”) just below the MOSFET on the board. Solder them in place.

Untape the board from your work table and rotate it 90 degrees so that the writing on the PCB board is on the “bottom”. This will make it easier to solder the last two parts.

— Mount the .1uF capacitor

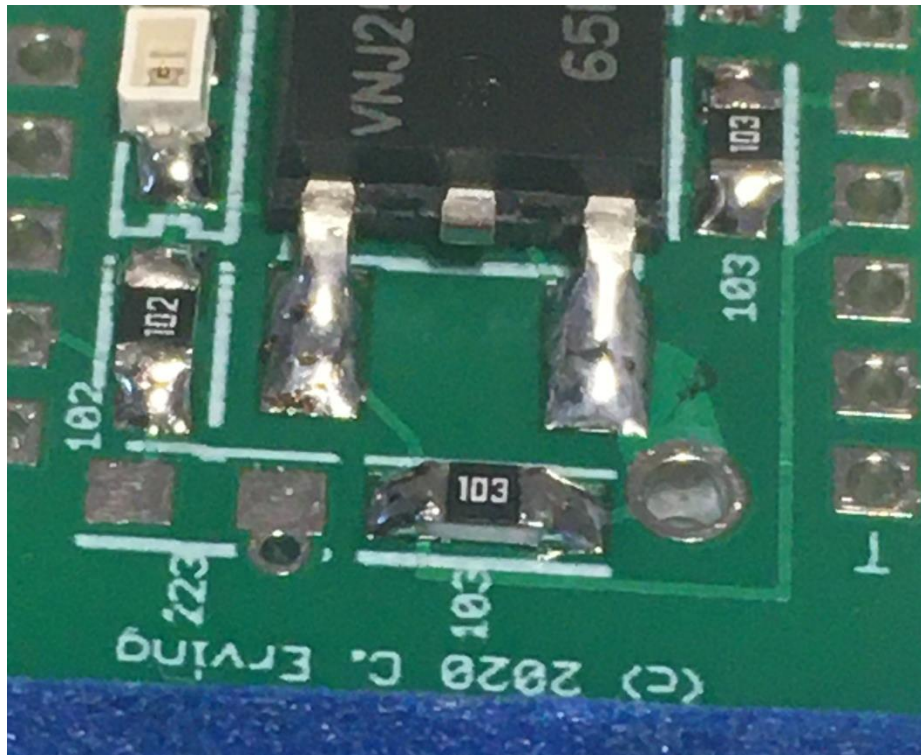
Locate the spot for the .1 uF capacitor, just above the MOSFET. The .1 uF capacitor is the one that comes in a PAPER carrier; it is not marked, so make sure you get the right part. Solder in place.





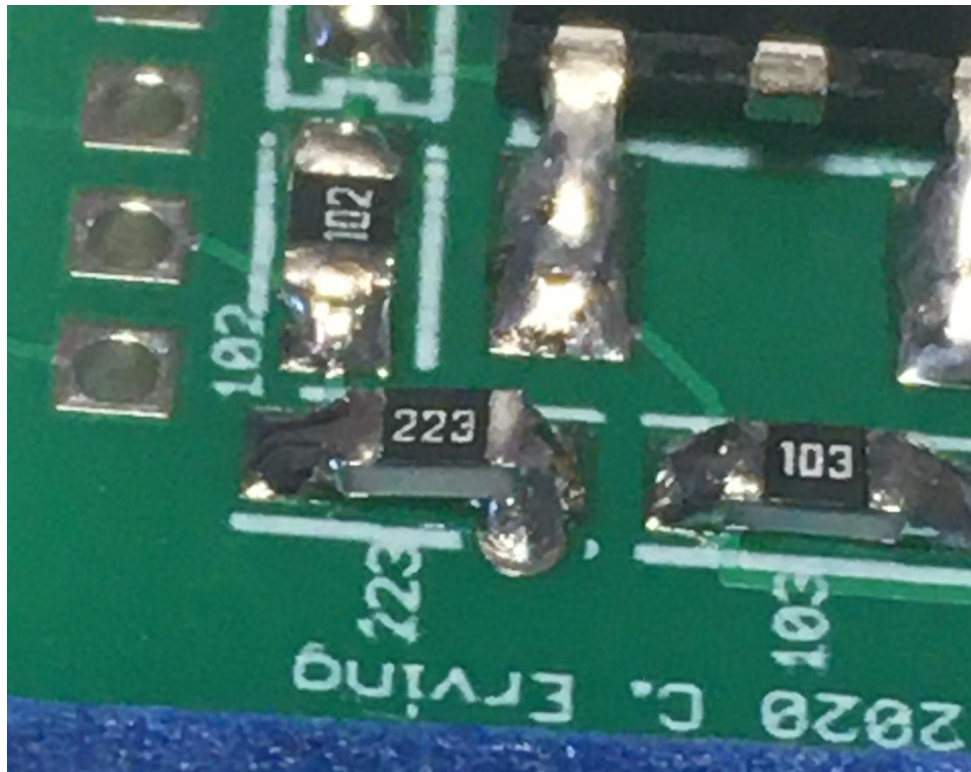
— Mount the 10K resistor

Locate the 10K resistor (marked “103”) just below the right lead of the MOSFET on the board. Solder it in place.



— Mount the 22K resistor

Locate the 22K resistor (marked “223”) just below the left lead of the MOSFET on the board. Solder it in place.



This completes the top-mount part of the assembly. Check all of the solder joints carefully with a magnifying glass or 10x jeweler’s loupe to make sure that you have good solder coverage and you haven’t created any solder bridges. When you’re satisfied with your work, untape the board from your work surface.

## The Bottom-Mounted Components

The rest of the parts are mounted on the “bottom” of the board, that is, the side that you’re not going to see when you mount it in your AV bay. You may find that a “third hands” board holder will come in handy... you’re going to be turning the board over and soldering the parts to the “bottom” side, but some of the parts are through-hole parts so the solder joints will be on the “top” side, so it isn’t really practical to tape the board down, especially when you mount the WiFi module because it goes all the way to the left edge of the board.

— Mount the 10 uF capacitors (Rev A6 board)

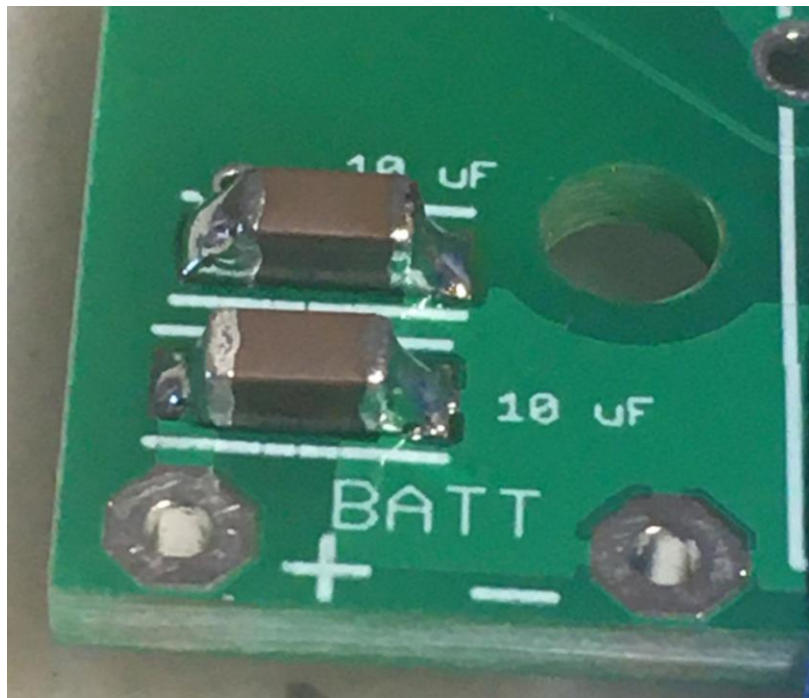
Locate the two 10 uF capacitors, on the left side of the board. These are the unmarked brown parts in a clear plastic carrier. Solder them in place.

— Mount the 1 uF capacitor (Rev A7 board)

Locate the spot for the 1 uF capacitor, on the left side of the board, it will be marked “1 uF”. The 1 uF capacitor will be the one in a clear plastic carrier with a BLACK stripe on the tape. Solder in place.

— Mount the 4.7 uF capacitor (Rev A7 board)

Locate the spot for the 4.7 uF capacitor, on the left side of the board, it will be marked “4.7 uF”. The 4.7 uF capacitor will be the one in a clear plastic carrier with a GREEN stripe on the tape. Solder in place.

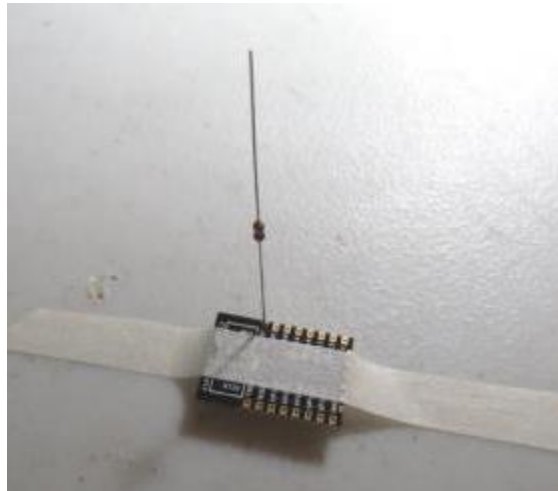


(Rev A6 board shown, Rev A7 is similar with “1 uF” and “4.7uF” markings)

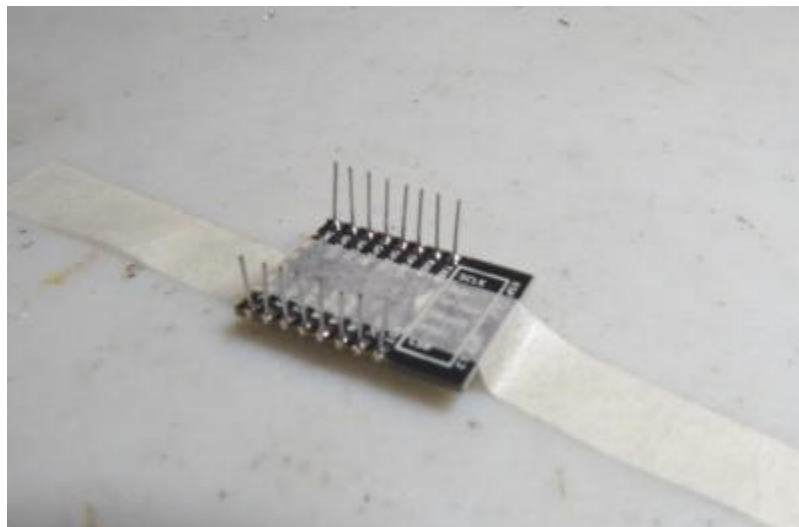
## — Mount the WiFi Module

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 passkey that you'll need to connect to your Mini 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 very 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 (about 3/8"). 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. Do NOT push the module in flush with the board... that spacing is important in the next step.

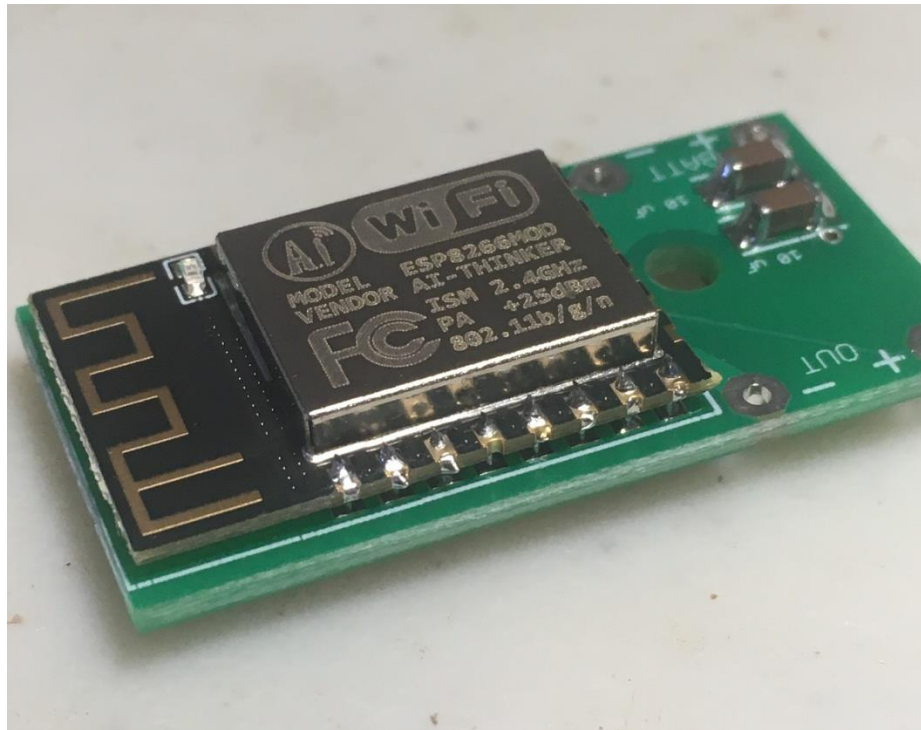
Now, turn the board over so you're looking at the "top" side (the side with all the little SMT parts), and solder the leads to the board. Again, use only enough solder to ensure that you have a good mechanical connection and that the holes are filled. This is why you space the WiFi module off the board a little bit... it prevents any excess solder from spreading out and shorting the pads on the WiFi module. Clip the leads as you go, making sure that the remnants don't land somewhere on the board.

When you are done, all 16 pads (8 on each side) should be soldered on the "top" side of the board. 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.

Get out your lighted magnifier and carefully inspect all of the solder joints. Make sure that there are no solder bridges, particularly on the WiFi module. If something doesn't look 100% right, resolder it, removing it first if you have to.

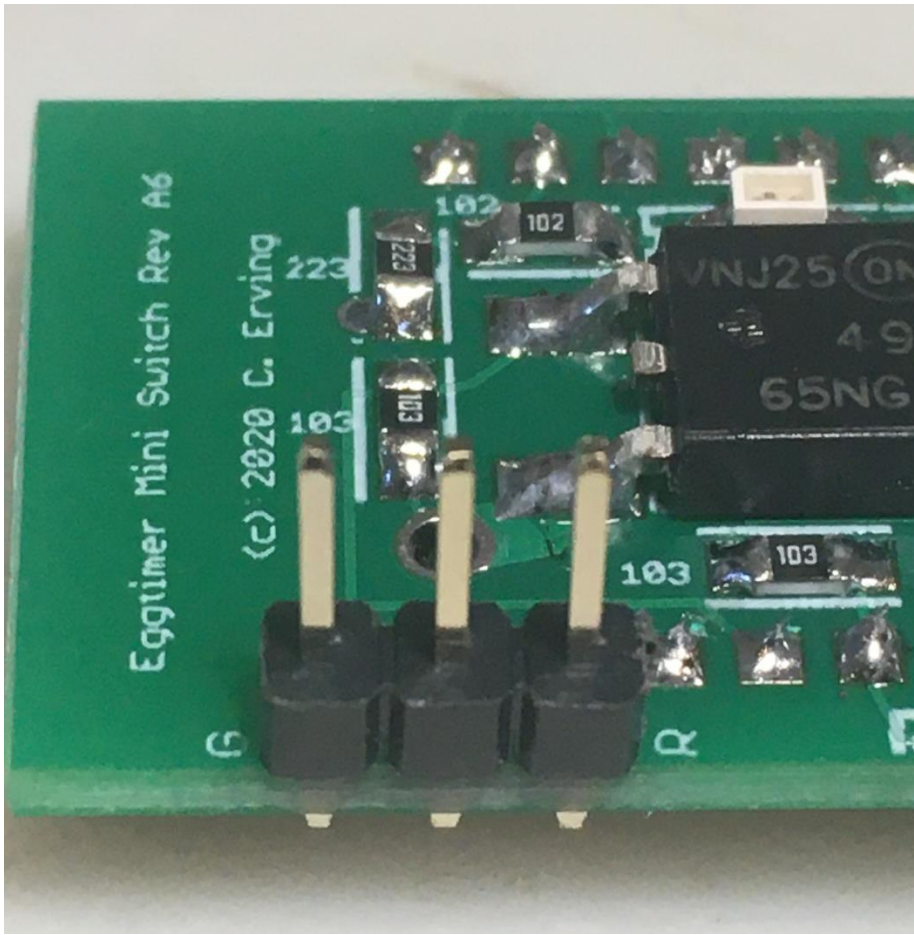




### — Installing the Header (optional... for now)

There is a 3-pin header included in the package, it's for use with updating the software and recovering the passkey if you lose it (you DID save the label on the package and write it down somewhere, right?). You do not need to install it for normal use, and it does stick up a bit so you might want to leave it off for now because it may make it harder to fit the Mini Switch into some smaller sized airframes. However, at some point you may need it, so here's how to install it.

Locate the spot for the 3-pin header on the top side of the board, it's at bottom edge of the board if you hold it so that the writing is on the left side. Push the short side of the header into the holes. Turn the board over, and CAREFULLY solder the three pads. They are very close to the pads on the WiFi module... in fact, they actually connect to the pads next to them, however we recommend that you use only a tiny bit of solder, enough to make a connection with the leads (creating a solder bridge to the WiFi module is NOT what you want to do!)





## **Preliminary Testing**

Solder your battery pigtails to the pads marked BATT. Make sure that the “+” lead (generally RED) goes to the “+” pad, and the “-“ lead (generally BLACK) goes to the “-“ pad. If you are not 100% sure of the colors and polarity of your battery pigtail, check them with a digital voltmeter and your battery BEFORE you connect it. **YOU WILL DAMAGE THE WIFI MODULE IF YOU HOOK A LIPO BATTERY UP BACKWARDS, SO TAKE YOUR TIME AND BE 100% SURE!**

Connect your battery to the pigtail. The amber LED should blink three times then remain on... if it does, congratulations! You're done. Read on for a detailed explanation of how to hook it up to your electronics and how to use it. If you're a bit impatient and want the 10-second tutorial, jump to the Quick Reference Guide at the end of this manual... if you get stuck, though, you just might end up reading the long version anyway!

If it does not, 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 good light and a 10x jeweler's loupe. About 99% of all the problems that we see are due to soldering issues.

## Mounting the Mini Switch in Your AV Bay

The Mini Switch has one #4 hole for mounting in a AV bay sled. It's about 1.5" x .75" x 3/8", so you'll need to make sure that you have enough room on your sled for it. 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.

Our favorite mounting method is to use one #4 hex-head cap screw, about 3/4" long, and a few nylon washers to act as a spacer between the bottom of the PC board and the sled. Don't screw the board tightly against the sled... you might break a solder joint. Use spacers or nylon washers. We also recommend that you put a nylon washer between the screw head and the top of the PC board, so that the metal screw head does not directly contact the board. 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. You can also simply use all nylon hardware... the switch weighs under 5 grams, so anything short of a monster lawn dart isn't going to break it loose.

We generally recommend that you try to mount the Mini Switch 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 Mini Switch 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 range of your Mini Switch, 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 Mini Switch from a reasonable distance, 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 Mini Switch...

The Eggtimer Mini Switch is designed for a battery from 4V-16V, this fits in nicely with the requirements of most hobby rocketry electronics. Ideally, a 2S/7.4V LiPo battery works with virtually every altimeter on the market, so that would be our first choice. Some altimeters (such as the Featherweight Raven and the Altus Metrum Easy Mini) are designed for 1S LiPo batteries; you CAN use those altimeters with a Mini Switch if you have the A7 version which supports 1S battery operation. Since the Mini Switch is designed to be used with a variety of different batteries, we don't provide a battery connector; you'll need to get whatever connector matches the battery that you're using. Typically, it will be a "JST RCY" connector (commonly just called a "JST" connector), they're polarized with a key so they theoretically can't be connected backwards (although we've seen some cheap knock-off connectors with such bad tolerances that it was easy to do just that... as with anything in rocketry, be careful what you buy).

The Mini Switch can use up to 85 mA of current and may have a startup current of up to 200 mA, 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 remotely monitor the battery voltage of your Mini Switch, 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 is under 3.6V per cell. 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 Mini Switch, unless you connect it right before launch and do not reuse it. 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.

## **Connecting To Your Electronics**

You will be hooking up your electronics to the OUT terminals of the WiFi Switch. The Mini Switch basically replaces the battery input on your altimeter, which is why you want to be using the same battery that you'd be using for your altimeter. Note that there are no terminal blocks on the Mini Switch... you will need to solder wires to the "OUT" pads, and connect those to your altimeter as necessary. Wire the "+" side of the OUT terminal to the "+" battery input on your altimeter, and the "-" side of the OUT terminal to the "-" battery input on your altimeter. Just like connecting a battery to your altimeter, make SURE that you have your connections right before you power up anything!

Since the Altimeter is going to be switched on and off by the Mini Switch, you will need to shunt any separate switch input that your altimeter may have. Generally, all you need to do is to connect a short piece of wire between the two switch terminals. When you turn on (and off) your Mini Switch, it will then power on (or off) your electronics.

## Using Your Mini Switch

The Mini Switch 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 Mini Switch will be "MINI\_SW\_nnnnnn" where nnnn is the last 6 hexadecimal digits of your device's MAC address (a unique address given to every Ethernet device).

The passkey is an eight-digit number generated by a random number algorithm the first time that your Mini Switch is powered on, and is saved in EEPROM memory at that time. It's going to be unique for every Mini Switch, and will not change. There should be a label on the little baggie that the WiFi module came in with the passkey, be sure to save it somewhere for future use. (If you lose it, don't fret... it can be easily recovered, see the section at the end of this manual).

Now, fire up your device's WiFi manager. Connect the battery to your Mini Switch... you'll see amber LED blink 3 times then stay on, and in a few seconds you should see your Mini Switch's SSID on your WiFi manager. Connect to the SSID using the passkey, and you should see that the status of your WiFi connection changes to Connected. You're now connected to your Mini Switch, and ready to start using it.

### **The Mini Switch Web Page**

After you've successfully connected to your Mini Switch using the SSID and passkey, start the browser for your device and type the following URL into the address box:

**<http://192.168.4.1>**

You should immediately see the Mini Switch page. We recommend that you add this page to your Favorites and/or bookmarks to make it easier to find. Note that if you have more than one Mini Switch the home page is going to be the same for all of them, so you only need to bookmark it once.

<b>Mini_SW_2abcd</b>	<b>1.02</b>
<b>Output:</b> OFF	
Toggle Output:	
Validation Code:	
<b>4567</b>	
<input type="text" value="....."/>	
<b>Submit</b>	
<b>Battery: 8.0v</b>	

The Mini Switch page shows you several things:

- The ON/OFF status of the switch's output
- The Validation Code that you need to use to turn it off/off
- The battery voltage

There is also a text box to enter the validation code to toggle the output, the validation code that you need to use is displayed immediately below the box.

Note that if you just sit and admire the screen for long enough (60 seconds, to be exact) it will refresh on its own, and you'll get a new validation code. This also refreshes the state of the battery, so if the voltage changes you'll know. You can also force a refresh by clicking on your browser's refresh icon, or by simply clicking the Submit button below the validation code text box.

Note that we've put an "ON" status LED directly on the board, you probably won't care much about it when it's locked up in your AV bay but it's very handy when you're testing because it shows you the actual state of your switch... you can test it before installing in your rocket.

When you first power on the Mini Switch, the output is turned OFF. To turn it on, click in the validation code text box and enter the 4-digit validation code, then click on the Submit button. The red LED should come on, and the Mini Switch's web page should show that the Output status is now ON (red highlighted box). If you make a mistake or for some other reason it doesn't "take", simply enter the next validation code and click on Submit. The ON/OFF status is the actual status of the output, so you can be confident that whatever status is being reported is what's really happening.

<b>Mini_SW_2abcd</b>	<b>1.02</b>
<b>Output:</b>	<b>ON</b>
Toggle Output:	
Validation Code:	<b>1784</b>
<input type="text" value="....."/>	
<b>Submit</b>	
<b>Battery: 8.0v</b>	

To turn off the Mini Switch, click in the validation code text box, enter the 4-digit validation code, then click the Submit button. The red LED will go out, and the status will change to “OFF” (grey highlighted box). The battery voltage will continue to be displayed, however, so you can monitor the battery before your launch.

Pretty easy, huh?

## **Flying with your Mini Switch**

Flying with the Mini Switch is a little bit different than using a mechanical switch. With a mechanical switch, you have everything disconnected until you're on the pad, then you turn it on. With the Mini Switch (or any other electronic switch, for that matter) you have to connect the battery to the switch when you're buttoning up your AV bay at your work table, then you activate it when you're on the pad. You don't want the switch coming on accidentally, which is why we have several "safeties" in place to prevent this from happening (WPA2-PSK encryption, unique SSID/passcode for each unit, validation code). There's no way that your Mini Switch can be turned on or off accidentally by yourself or anyone else.

Once you've checked everything out, close up the AV bay and finish prepping your rocket. You can close the browser page if you want, and you can even shut off the WiFi connection on your device. The page will be there waiting for you when you're at the pad.

Take the rocket to your RSO/LCO, get it cleared and take it out to the pad, hang it on the rod/rail, and re-connect to your Mini Switch. Note that the validation code is undoubtedly going to be different than what it was when you disconnected, since it changes every 60 seconds. Make sure that your battery voltage is good, then enter the validation code in the text box and click Submit to turn on the switch. Your altimeter will begin its startup sequence, once you're satisfied that it's ready to go then you can hook up your motor's igniter and be ready to fly.

After you've recovered your rocket, you may or may not want to turn the Mini Switch off immediately, it's going to depend on whether or not you need to hear the altitude beep-out or do something else with it. No problem, you can connect to it to check the battery voltage, and turn it off (or leave it on) as appropriate. Just remember that it's still drawing power from the battery, so we recommend that you take apart your AV bay and disconnect the battery when you get back to your work table.

## Troubleshooting

If your Eggtimer Mini Switch doesn't work after assembly and testing, take a deep breath, get out a beverage to clear your 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. 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 and may be difficult, if not impossible, to remove.

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 Mini Switch 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 (preferably) a vacuum bulb to remove the excess, then heat it up and resolder the joint.

### Check Your Component Polarity

Most of the SMT 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.

In particular, you need to check the LEDs, the side with the green dot match up with the "notch" silkscreened on the board. They're difficult to remove and resolder, so make sure you get it right the first time.

If you inserted a component incorrectly, you will have to carefully unsolder it, clear any solder residue from the holes (if it's a through-hole part), and resolder it. If you find that a through-hole 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 Mini Switch 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](mailto: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-up blinks from the amber LED

- Battery cable connected incorrectly  
(Match “+” and “-“ on the INPUT side with your battery connector)
- Bad solder joint on voltage regulator
- Bad solder joint on 10 uF (Rev A6) capacitors or 1 uF/4.7 uF capacitors (Rev A7)
- Bad solder joint on the ESP8266-12 module
- LED mounted backwards (green dot needs to be on the “notched” side)
- Weak battery

### Voltage regulator gets hot to the touch and no blinks from the amber LED

- There’s a short somewhere between the 3.3V output and GND.... You need to get out a jeweler’s loupe and CAREFULLY examine all the solder joints. You will probably find that there’s a bridge either between the pads of one of the resistors or capacitors, or that there’s a solder bridge underneath the WiFi module or one of the 8-pin SOIC IC’s.
- Check to make sure that a stray cut-off resistor lead didn’t get underneath the WiFi module

### Don’t see an “MINI SW ...” SSID

- Bad solder joint on ESP8266-12 module
- Weak battery
- Incorrect settings on client

### Can’t connect to “MINI SW...” 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 Mini Switch web page

- Bad WiFi connection (check your WiFi manager)
- Incorrect URL (use **http://192.168.4.1** )
- Weak battery (use a freshly charged one)
- Tell your client to NOT connect to the Internet when you connect to the SSID

### Switch won’t turn on when I enter the code and click Submit

- Bad solder joint on the red “ON” LED or LED reversed
- Bad solder joint on 2.2K resistor next to the ON LED
- Bad solder joint on the ESP8266-12 module
- Bad solder joint on the MOSFET
- Bad solder joint on the 10K resistor next to the MOSFET
- Weak 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

## **Eggtimer Mini Switch Quick Reference Guide**

**To Connect:** Connect with your device's WiFi to "MINI\_SW\_#####", where "#####" is the unique 6-digit hex code for your Mini Switch, and the passkey is the one on the package (or displayed through the serial port at power-up)

**To Turn ON/OFF:** Enter the displayed validation code then click Submit

**To Find Passkey:** Connect USB-Serial cable to the 3-pin header:

BLACK: G  
WHITE: T  
GREEN: not used

Set your terminal program to 115,200/8/N/1  
Turn it on... the SSID and Passkey will be displayed  
(don't enter the space between the digits on the passkey, though!)

**To Connect to your Altimeter:**

Connect your battery connector to the BATT pads:  
"+" to "BATT +"  
"-“ to "BATT-“

Connect your Altimeter battery input to the OUT pads:  
"OUT+" to altimeter battery "+"  
"OUT-“ to altimeter battery "-“

**Specifications:**

Input: 4V-16V, approx.. 85 mA (we recommend at least as 300 mAH 2S LiPo battery)

Output: Voltage: Same as input, 13A max. continuous

WiFi Module: Espressif/AI-Thinker ESP8266-12F  
FCC ID: 2ADUIESP-12 or ESP8266MOD

Range: Typically 100'; up to 200' under ideal conditions

Security: WPA2-PSK, AES encryption  
Passkey: 100,000,000 possible combinations  
4-digit changing validation code required to toggle power

## Recovering the Passkey

The passkey for the Mini Switch is marked on the package, and we recommend that you record it somewhere for future reference. The “Notes” application on your phone/table is a good place for it... just reference the SSID along with the passkey. However, if you do manage to lose the passkey, it’s not very hard to recover it.

To get 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 (if you haven’t installed the 3-pin header, now would be the time to do it...):

BLACK wire – G  
WHITE wire – T  
GREEN wire – not used

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

**(a few lines of garbage... this is normal)**

```
Mini Switch v1.02  
SSID: MINI_SW_FFD521  
PASSKEY: 2391 4739
```

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.

## Updating the Mini Switch Firmware

Occasionally, we may release software updates for the Mini Switch. You can update the software easily using the Eggtimer USB-Serial cable, the current version of the software can be found on the Eggtimer Rocketry web site under “EggtimerRocketry.com/support/Mini Switch”

Here’s how to do it. We recommend that you read ALL of the steps before you start.

- 1) If you haven’t installed the 3-pin header already, do so at this time.
- 2) Temporarily solder a bridge across the two pads marked “PGM”, at the bottom edge of the board. You will be removing this bridge after you successfully program the board.
- 3) Download the latest software update from eggtimerrocketry.com, you can find it at the Support / Eggtimer Mini Switch page.
- 4) Unzip the download files to c:\eggtimer (create the directory first if it doesn’t exist).
- 5) Open up a Command Prompt, and type cd c:\eggtimer
- 6) Plug the USB-Serial cable into your computer.
- 7) If your COM port is NOT COM2, edit the “Mini\_Switch\_<version>.bat” file, where <version> will be the latest version (i.e. Mini\_Switch\_1\_02.bat) and change COM2 to COM3 or whatever port you’re using. Save the file.
- 8) Connect the serial cable to the 3-pin header on the Mini Switch as follows:
  - BLACK – G
  - GREEN – R
  - WHITE – T
- 9) Connect your battery to the Mini Switch.
- 10) Now, from the Command Line (which should be at “c:/eggtimer”) type “Mini\_Switch\_<version>.bat”, where <version> is the current version of the software (i.e. 1\_02). For this example, you’d type **C:/eggtimer Mini\_Switch\_1\_02.bat**
- 11) You should immediately see some text scrolling across the screen, and in about 3-5 seconds you should see a bunch of dots going across your screen (.....). This should go on for about a minute, then everything should stop.
- 12) Your Mini Switch should give you the normal power-up blinking. If it does not, unplug the battery, take a look at your files, your COM port, your connections to the 3-pin header, etc., then repeat steps 8-11.
- 13) Unplug the battery, and remove the solder bridge across the PGM pads with some desoldering wick.

You can confirm that you’ve uploaded the right version by simply connecting to your Mini Switch with your WiFi device, the software version will be in the upper-right corner of every page.

As usual, if you have any questions, feel free to drop us a line at support@eggtimerrocketry.com.

## **Eggtimer Mini Switch Limited Warranty**

Eggtimer Rocketry warrants that all of the parts listed in the parts list necessary to build the Eggtimer Mini Switch 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](mailto: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 Mini Switch 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 Mini Switch 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 Mini Switch and there is no way that we could possibly test them all, we do not warrant the suitability of the Eggtimer Mini Switch 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.