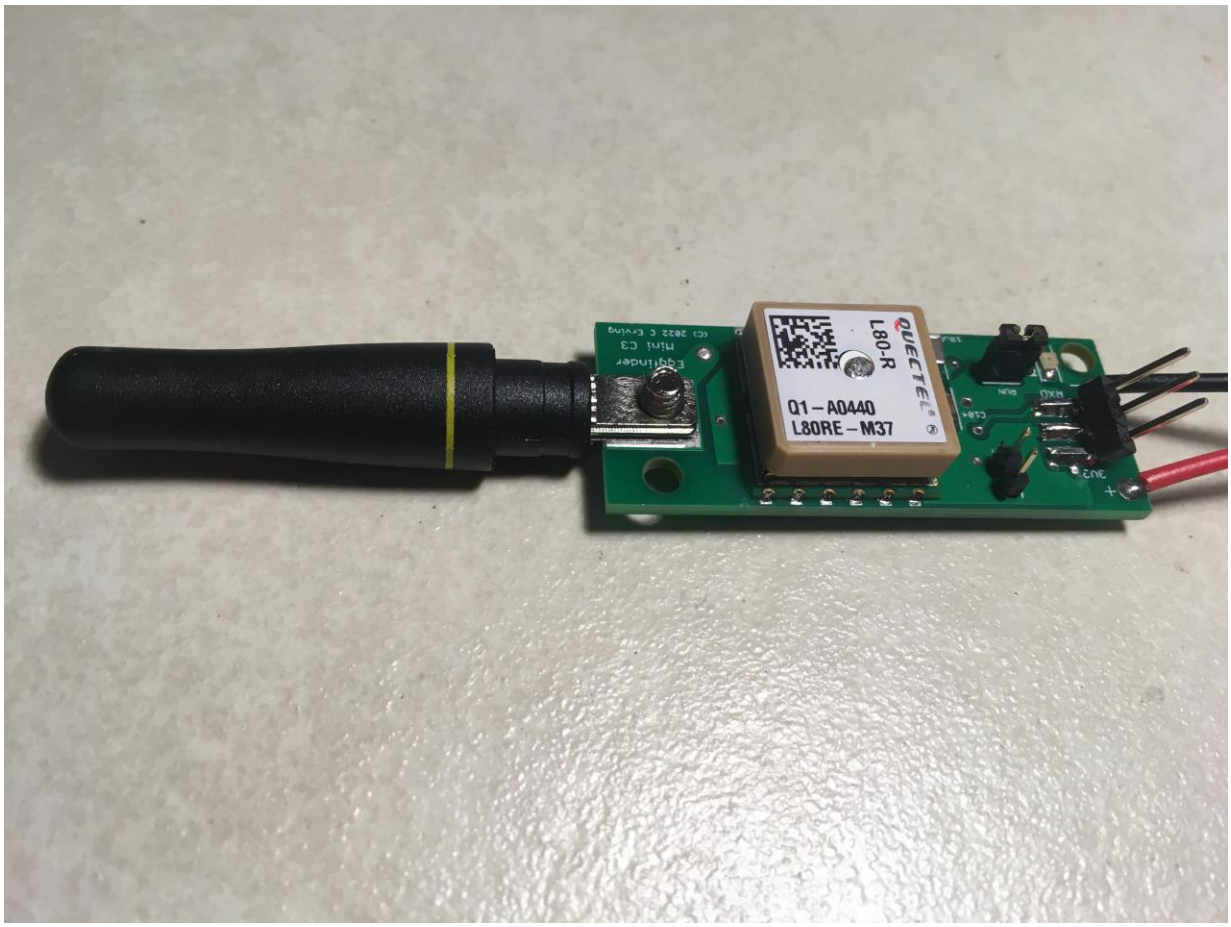
Eggfinder Mini
Assembly Manual

Rev. C3



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. 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 902-928 MHz band, and therefore must not be used in residential areas.

The Eggfinder Mini uses RF modules in the 902-928 MHz ISM band manufactured by Hope RF, model HM-TRP-915. These modules have been tested by Hope RF to be compliant with the FCC Part 15 regulations for non-licensed intentional emitters, and as such have been permitted to be imported into the US. However, Hope RF (at the time of this document) has not obtained formal certification with the FCC. As a hobby kit, designed for educational and experimental purposes, the Eggfinder is considered by the FCC to be "generally exempt" from authorization requirements. Nonethless, 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 using only the antenna on the transmitter module that is included with the kit.

Because the Eggfinder Mini 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 Eggfinder system is unlikely to be significantly affected by outside radio sources, but there's no guarantee.

If your Eggfinder Mini 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 the "tightness" of the transmitter's output, and in particular the distance from any populated areas 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 wireless phones, WiFi and Bluetooth® devices, and garage door openers.

Important Links:

FCC Part 15 (governing unlicensed intentional emitters)
https://www.ecfr.gov/current/title-47/part-15

Hope RF HM-TRP Documentation (FCC test documentation)
https://www.hoperf.com/data/upload/back/20190304/HM-TRPW-915(20dBm)-FCC%20Test%20Report.pdf

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

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Before You Start…

• Go to our web site at www.Eggtimerrocketry.com and download the latest Release Notes.

• 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 Eggfinder Mini GPS Tracker! The Eggfinder Mini is a hobby rocketry GPS tracker that uses a GPS module and a 900 MHz license-free transmitter module to broadcast your rocket's location in real-time to a suitable Eggfinder receiver. With appropriate GPS tracking software on your PC/Android which is available for free on the Internet, or using the Eggfinder LCD Receiver, you can actually track your rocket in flight, and ultimately find out exactly where it landed.

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 the Eggfinder, 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!).

The Eggfinder Mini is the smallest GPS-Radio tracker around, it fits into an 18mm (BT20) body tube, and it's just over 3" long including the antenna. It works with all Eggfinder receivers, and the frequency can be programmed to any of of the 72 frequency/ID combinations using the Eggfinder LCD display receiver. Despite its small size, it has a range of well over 20,000', so it's great for about 99% of the HPR flights that most hobbyists do.

About Soldering Your Eggfinder Mini…

Assembling your Eggfinder Mini 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 Eggfinder Mini uses mostly Surface Mount Technology (SMT) parts, but they are large by SMT standards, and are within the realm of being hand-solderable. In our case, the RF module could potentially be damaged by the heat of surface-mounting them in an oven; that's why we chose to have you solder them. 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 about using extra flux with this board: The solder that comes with the kit is Kester 245, it uses a water-based "no-clean" flux. If you wish to use extra flux with the board, it MUST be compatible. You want a liquid (not paste) water-based no-clean flux. Kester 951 is ideal, if you can get it. Chip-Quik sells little 2ml tubes for about $2 each (unfortunately they sell them in 6-packs, you can't just get one) which works very well. If you decide to add flux, you must use only a tiny amount. One drop will suffice for the entire RF module. DO NOT use Rosin Core flux, or you will make a mess of the board and possibly damage components. We have built many kits without using any additional flux without any issues, the board is pre-tinned to make solder adhesion easier so in general you should not need to use additional flux.

For soldering components on a board like the Eggfinder Mini, 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. The Hakko FX888D is a good one for about $100, 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 a small conical tip. It should be just about the same width as the GPS module pads. If you have a temperature-controlled iron, set it to 680F; you may need to adjust that temperature up or down a little if you find that the solder balls up (too cold) or fizzles without flowing out (too hot).

General Assembly Information

We're sure that you are ready 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 "third hands" stand or small vise to hold the board in various positions

___ A tinning block and brass mesh "sponge" for cleaning the tip of your soldering iron

___ A lighted magnifier, for inspecting solder joints

___ A jeweler's loupe or small 10x magnifier, for inspecting the SMT solder joints

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

___ Some ¾" 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 Eggfinder, 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, under the "Photos" section. http://www.eggtimerrocketry.com/page16.php

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 Eggfinder Mini Board

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. (Yes, we ARE human and sometimes make mistakes… 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…

	Qty	Description
__	1	Circuit board with pre-mounted GPS Module
__	1	Hope RF HM-TRP-915 RF module
__	1	LDL1117-33 3.3V voltage regulator
__	1	MBRS130L diode (black with a stripe on one end)
__	1	0805 Amber LED (it may be clear)
__	1	330 ohm 1206-sized resistor (marked "331" or "3300")
__	1	0.1 uF 1206 sized capacitor (brown, unmarked, in PAPER tape)
__	1	1 uF 1206-sized capacitor (brown, unmarked, in tape with BLACK stripe)
__	1	4.7 uF 1206-sized capacitor (brown, unmarked, in tape with GREEN stripe)
__	1	10 uF 1206-sized capacitor (brown, unmarked, in CLEAR tape with NO stripe)
__	1	3-pin right-angle header strip
__	1	2 dB stubby screw-mount antenna & screw
__	1	Coil of .020" 63/37 No-Clean solder wire
__	1	8" 3-conductor jumper, female-female

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 Eggfinder Mini 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 Eggfinder Mini, 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 Eggfinder Mini 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 (diode). 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 Eggfinder 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.

There are several different capacitor values, so make sure you get the right ones in the right place. They are marked on the boards, but once again you need to make SURE that you have them in the right place before soldering. Unsoldering parts on a small circuit board like the

Eggfinder isn't a lot of fun, even if you have a vacuum desoldering tool. Trust us, we've been there before…

It is very important that you assemble the Eggfinder Mini 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 will call for you to tack-tape parts to the board to maintain alignment while you solder, or to protect sensitive areas from 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.

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 Eggfinder Mini 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.

Mounting the Resistors and Capacitors

The resistors and capacitors are 1206-sized surface mount parts, yes they are small. However, they're really not hard to mount, once you know the trick and you've done a few. They key is to follow the below-listed procedure exactly… if you do, you'll wonder why you ever thought that this was such a big deal.

1) Very lightly tin ONLY one of the resistor pads.

2) Holding the part with tweezers in one hand and your soldering iron in the other, center the part on the pads.

3) Once you have it where you want it, touch the tip of the soldering iron to the pad until the solder which you previously tinned the pad with melts.

4) Hold the iron for about 2 more seconds then remove the soldering iron, still holding the part in place.

5) Wait about 5 seconds then let go of the part.

6) Now, solder the untinned pad to the part using only a tiny bit of solder, just enough to cover the pad and have it "wick" up the side of the part. This will take a very short time, so be ready to remove the soldering iron within a few seconds. If you leave the iron on the part for too

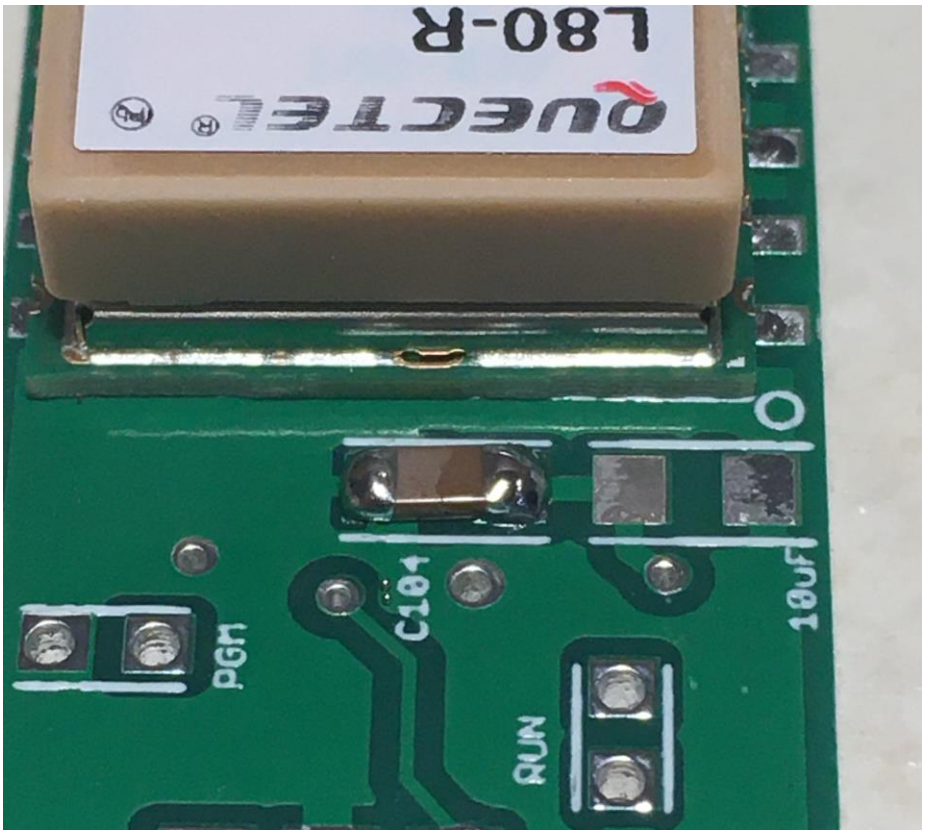
long, you may heat up the previously-soldered joint, and when you withdraw your soldering iron it will come off the board and stick to your tip, or it will "tombstone" and lay up on end. If that happens, heat up the joint, remove the part, and try again.

7) Inspect the joints, and reheat/solder them if they don't look nice and shiny. You may end up resoldering the joint that you tinned originally, because chances are that it doesn't have enough solder to wick up the side of the part. If you do reheat the part, be careful not to overheat it; if you do, both solder joints may melt and you may end up lifting the part off the board.

OK, so let's get started… we'll start with the parts on the GPS side of the board, then turn it over and mount the "other" side. Tape the board to your worktable, or use a Panavise or similar hobby vise to hold the board securely so that the GPS module is "up".

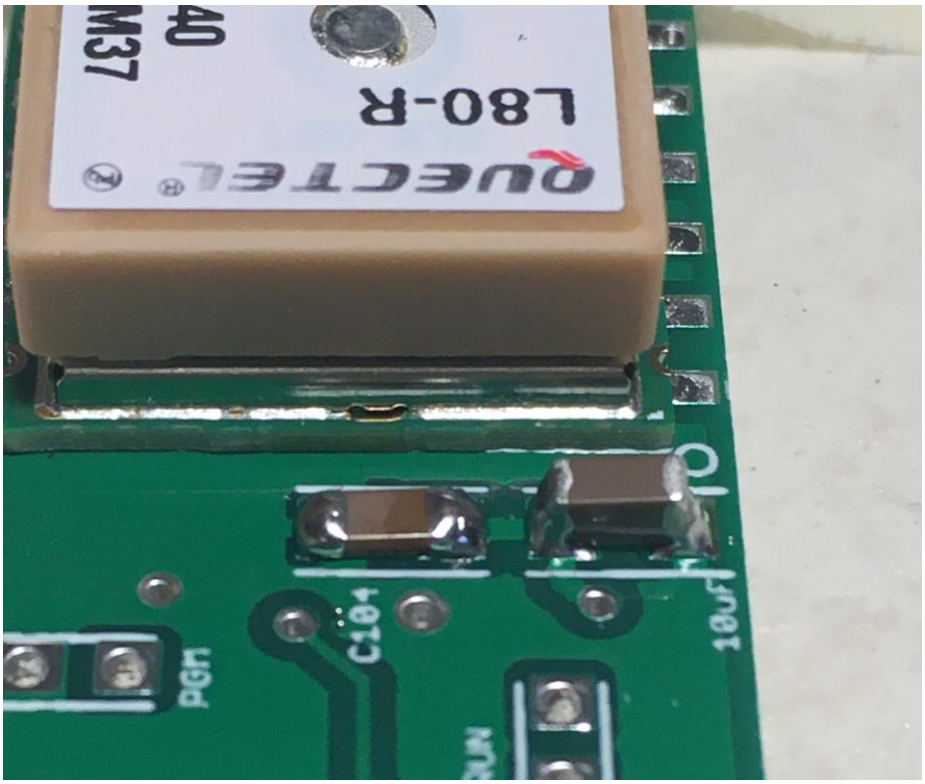
___ Mount the 0.1 uF capacitor (brown unmarked part in PAPER tape)

Locate the 0.1 uF capacitor on the GPS side of the board, it's marked "C104" on the board, it should be in the middle of the board right below the GPS module. Per the procedure above, mount the capacitor.



___ Mount the 10 uF capacitor (brown unmarked part in CLEAR PLASTIC tape)

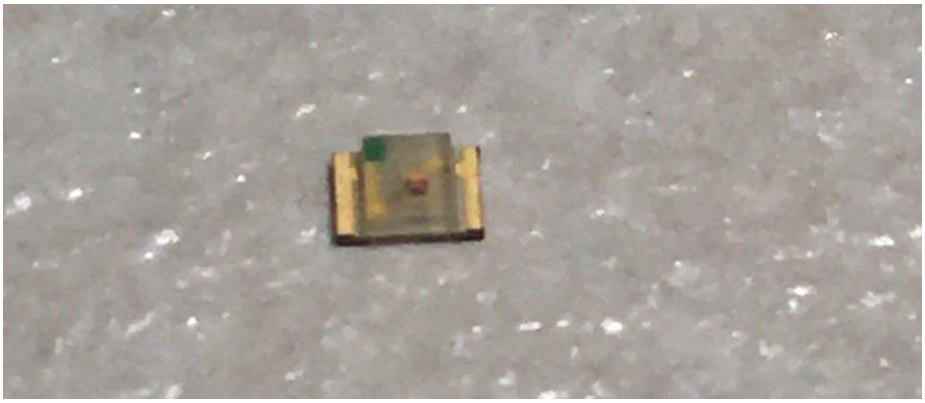
Locate the 10 uf capacitor, next to the 0.1 uF capacitor that you just mounted. Mount it per the procedure above.

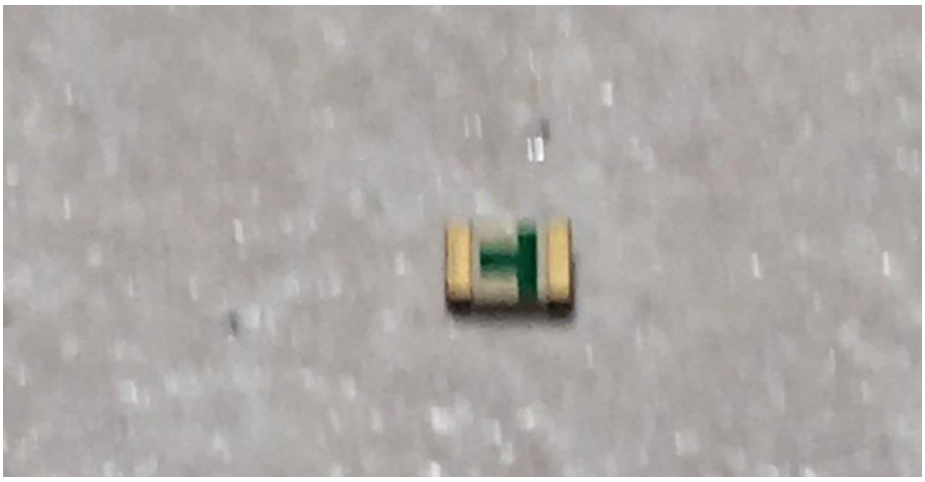


___ Mount the LED

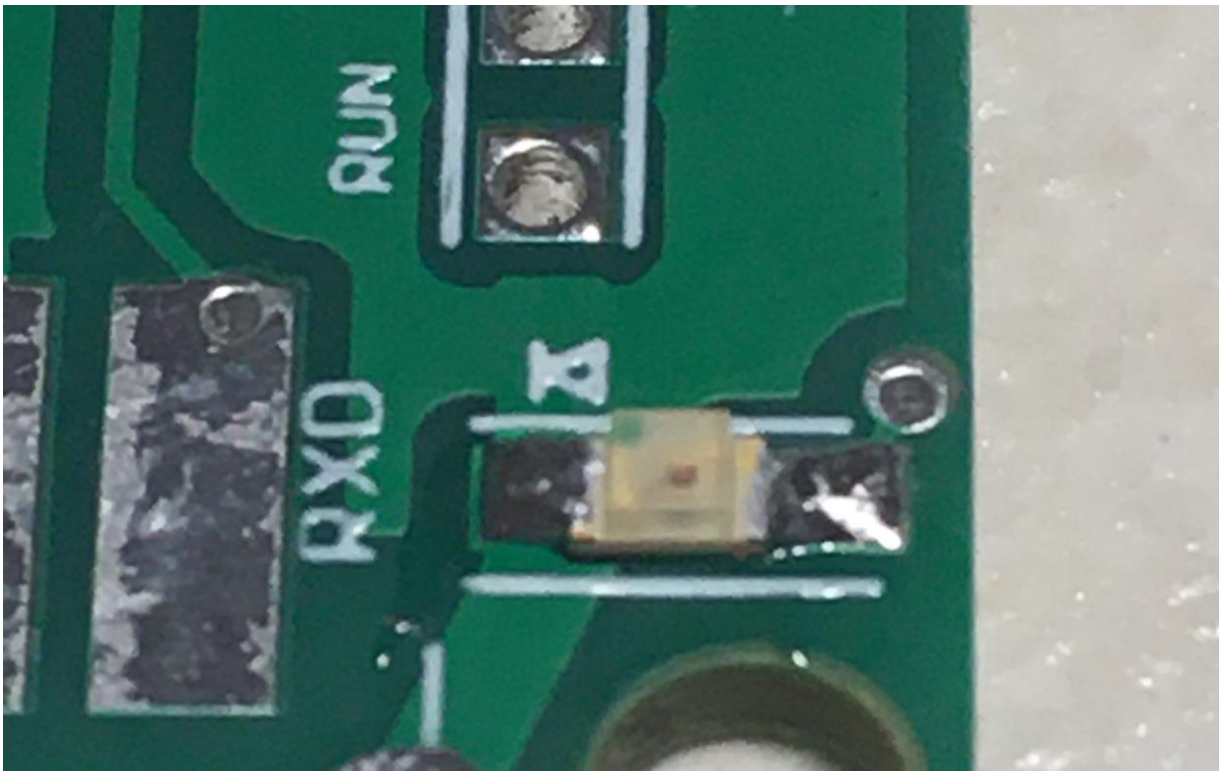
Locate the spot for the LED, it's next to the mounting hole. You will see that on one side it has the schematic marking for a diode ►|.

Carefully remove the LED from its carrier. Yes, it's VERY small. One side of the LED is marked with either a color dot, or a notch out of the case. You may need to use a 10x jeweler's loupe to find it. If you turn it over, you may see a "T" mark… the "long" side of the "T" should point towards the same side with the color dot.





Locate the LED onto the board so that the notch/mark is on the side with the diode marking on the PC board (►|). Mount the LED onto the pads, similar to the other parts.

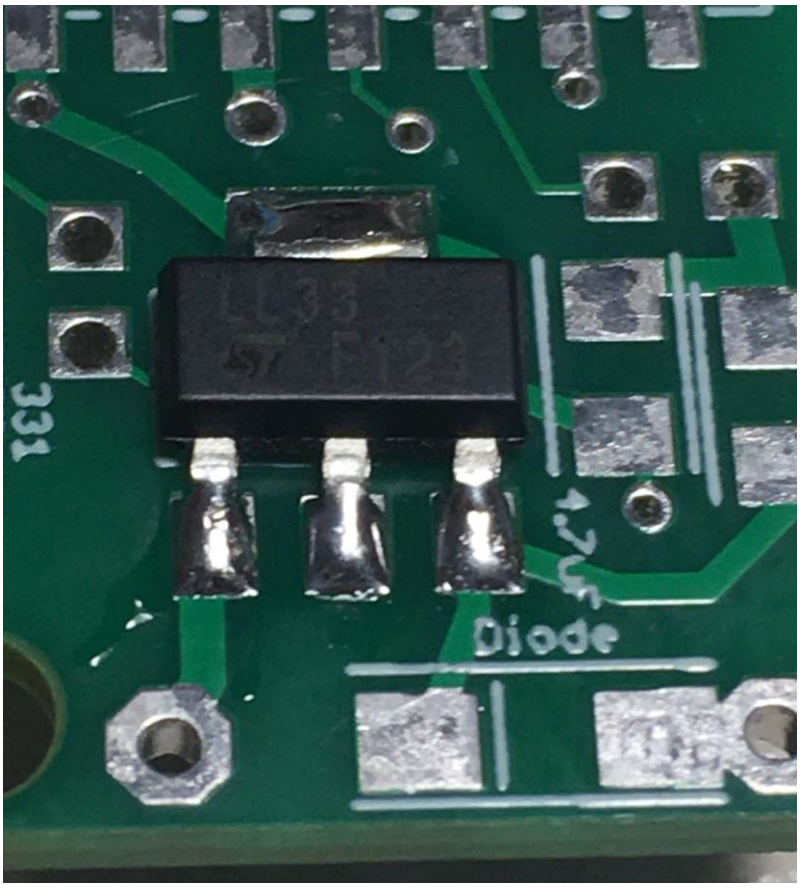


Turn the board over, so that the GPS side is “down”. If you don’t have a hobby vise and are taping it to the board, use plenty of tape… you don’t want it moving while you solder the parts to the board.

___ Mount the Voltage Regulator

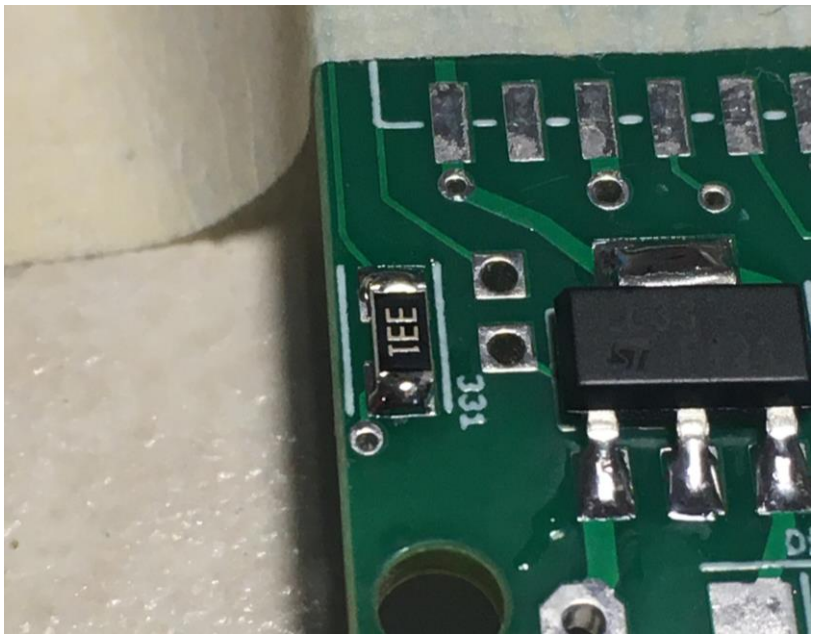
Locate the large pad and the three small pads for the voltage regulator. Heat up the large pad with your soldering iron and flow some solder on the large pad, just enough to cover it. Place the voltage regulator IC in place, and hold it down, then heat up the large pad on the voltage regulator until the solder starts to flow. Hold your soldering iron on the pad for another 5 seconds, then remove it and wait at least 15 seconds. The large pad on the voltage regulator should be firmly bonded to the pad, if not then wait 30 seconds, heat it up again, until it is. You may have to apply a little more solder if you reheat it.

One by one, solder the three small three small leads to the pads, using enough solder to cover the pads, and making sure that there is enough solder to completely bond the leads of the voltage regulator. Wait at least 15 seconds between each pad to prevent the chip from overheating.



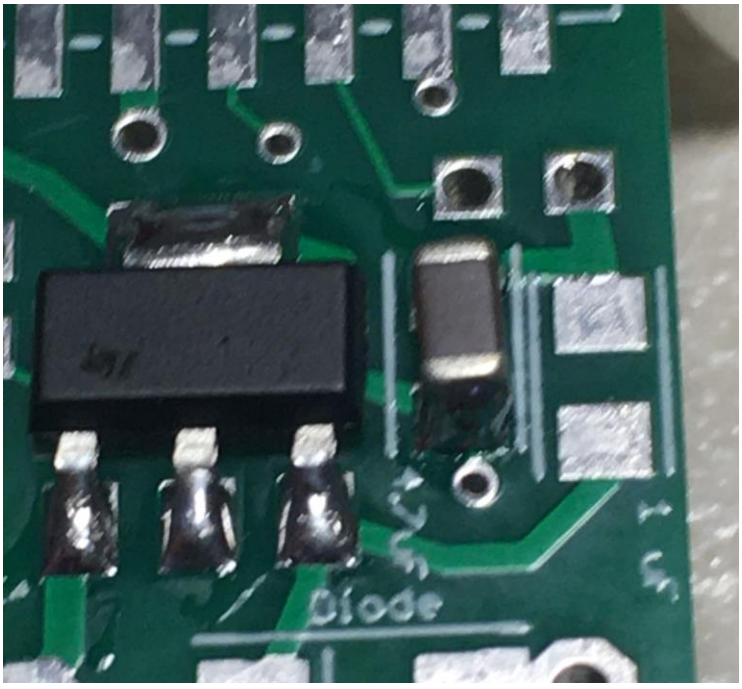
___ Mount the 330 ohm resistor (marked “331” or “3300”)

Locate the 330 ohm resistor just to the left of the voltage regulator, it’s marked “331” on the board. Mount it according to the procedure above.



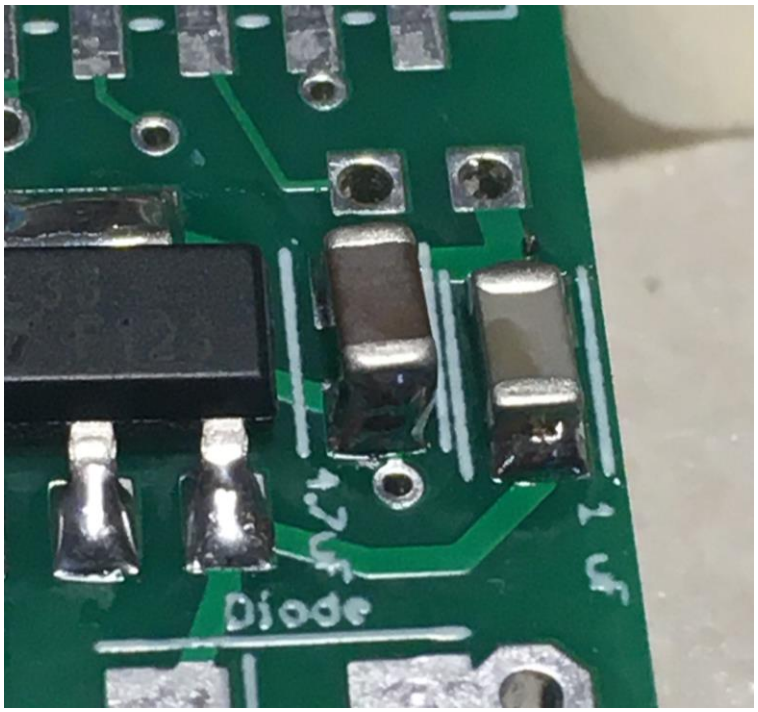
___ Mount the 4.7 uf capacitor (brown unmarked part in clear tape with GREEN stripe)

Locate the spot for the 4.7 uF capacitor, it's just to the right of the voltage regulator and is marked "4.7 uF" on the board. Mount it per the procedure above.



___ Mount the 1 uf capacitor (brown unmarked part in clear tape with BLACK stripe)

Locate the spot for the 1 uF capacitor, it's just to the right of the 4.7 uF capacitor that you just mounted, and is marked "1 uF" on the board.. Mount it per the procedure above.

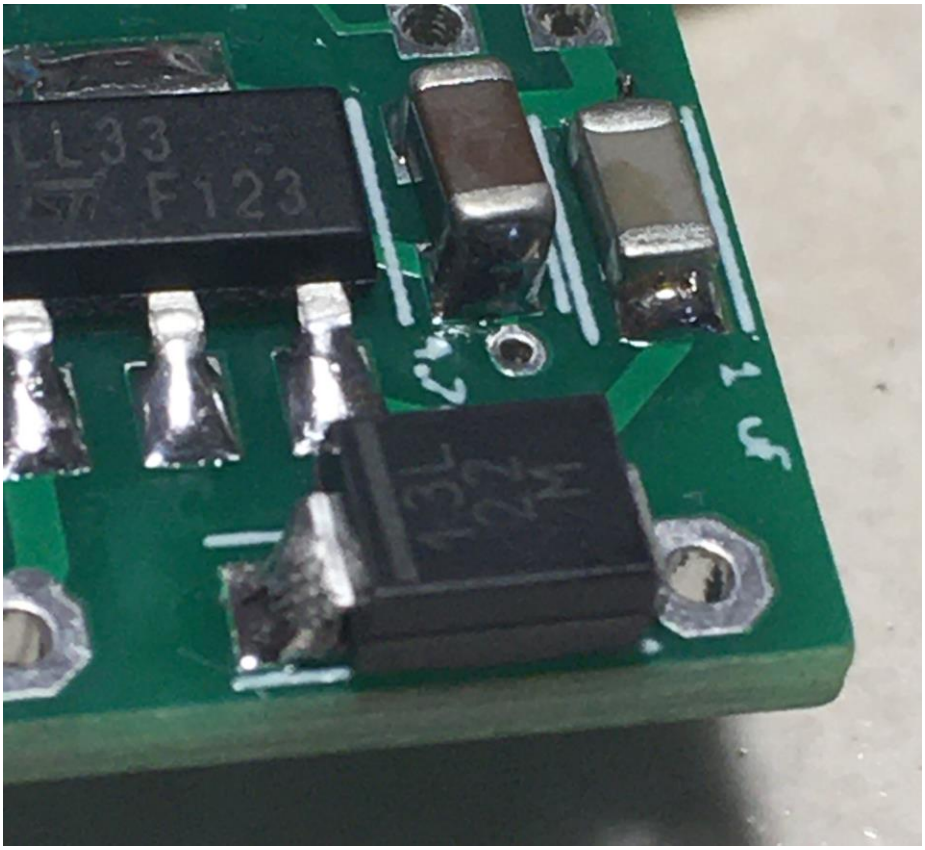


___ Mount the Diode

Unpack the diode from its package, if you look at it closely you'll see that one end has a stripe on it.

Locate the spot for the diode at the far right edge of the board, you'll see that it's marked "DIODE" and that one of the pads has a stripe right next to it. Tin the pad with the stripe on it lightly.

Place the diode so that the stripe on it is over the tinned pad on the PC board, heat up the pad, and slide it into place. DO NOT solder the other pad yet (the one without the stripe, which is next to the "+" battery pad). You'll solder that one later, when you install the battery connector pigtail.

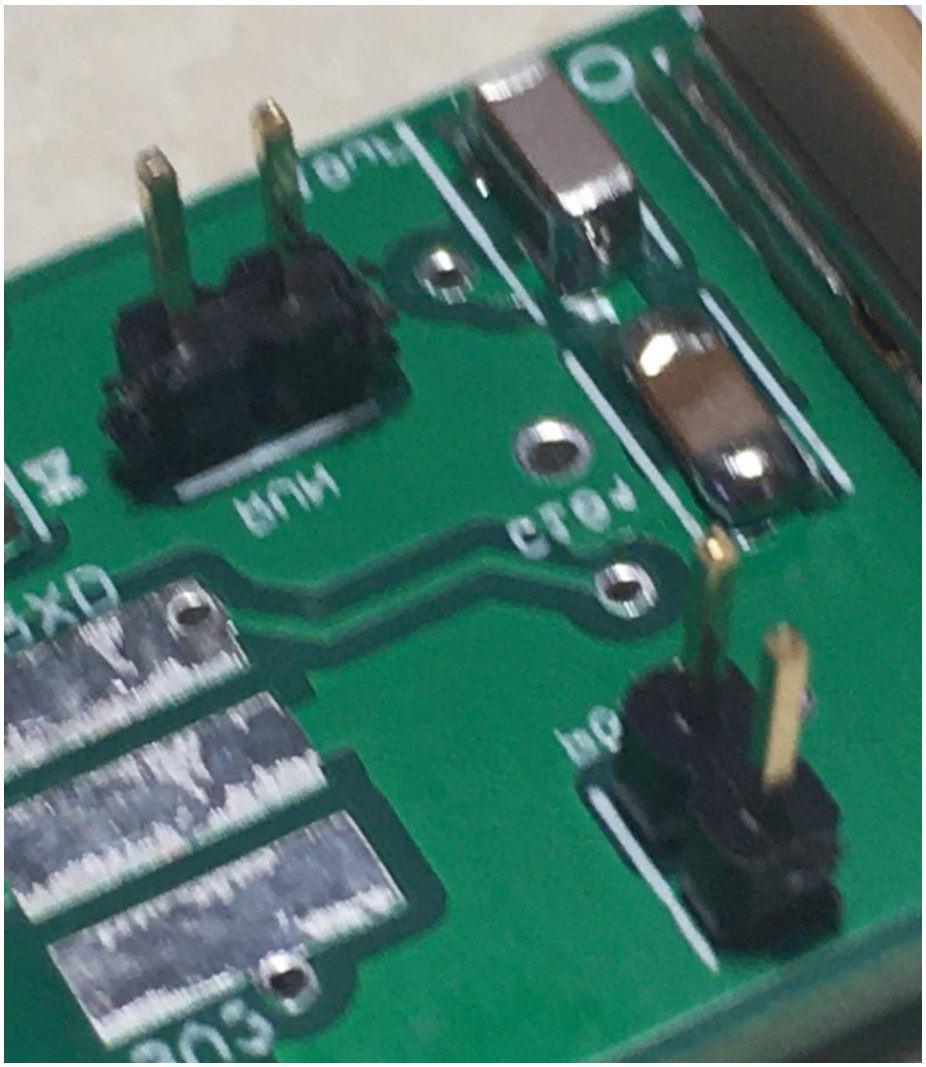


Soldering the Headers and the Battery Pigtail

Turn the board over so that the GPS module is facing up again.

___ Mounting the 2-Pin headers

Locate the two 2-pin headers, marked “RUN” and “PGM” on the board. Insert the 2mm headers onto the board so that the short side of the headers goes through the board. Use some paper masking tape to hold them into place, then turn the board over and solder them in place.



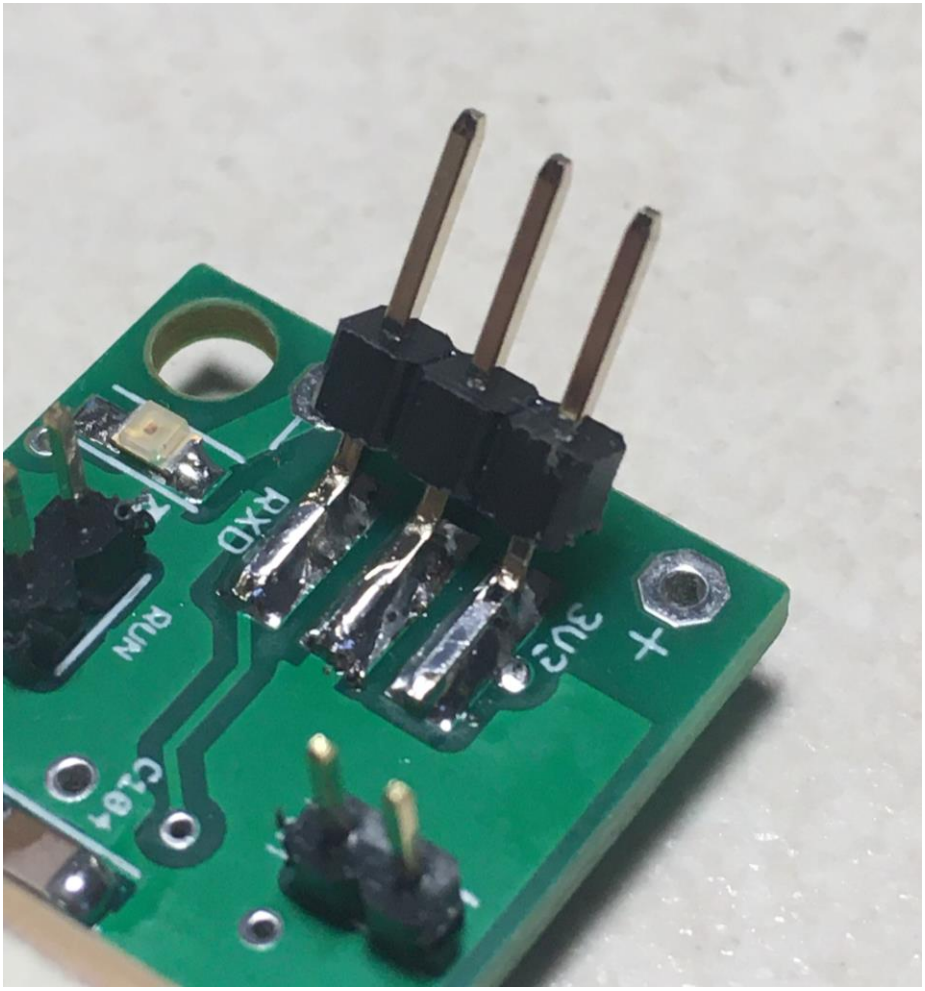
___ Mounting the 3-pin Header

With a pair of needle-nose pliers, bend the short side of the 3-pin header out so that it's at a 135 degree angle (45 degrees out from vertical).

Locate the spot for the 3-pin header, there are three relatively large pads near the edge of the board, and next to the diode. Generously tin the center pad… it will take a fair amount of solder to attach this header.

With a pair of pliers, hold the 3-pin header so that the long side faces outward (AWAY from the GPS module), heat up the tinned center pad, and place the short side of the header onto the pads. Remove the heat and hold the header for several seconds until the solder cools. It should be nice and square on the pads… if not, redo it.

Solder the other two leads onto the pads, and wait several seconds between them so the solder cools between pads.

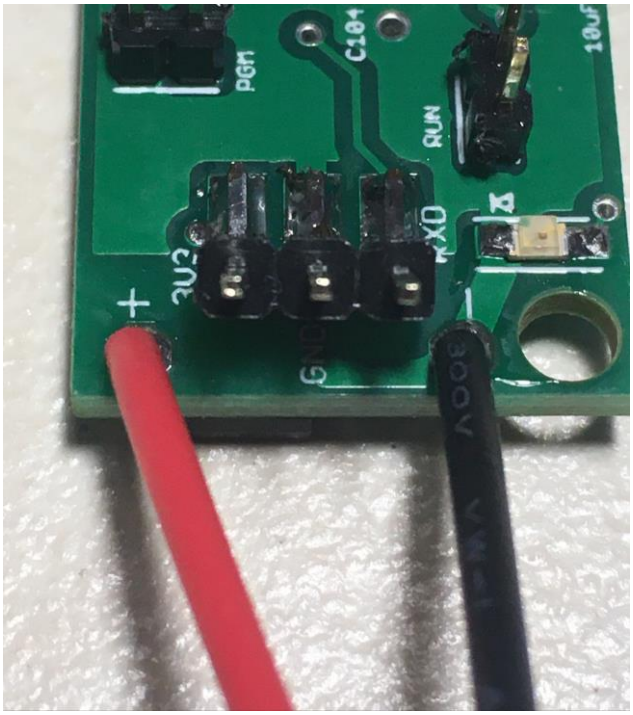


__ Solder the Battery Connector

(See the discussion on powering your Eggfinder Mini first, if you do not have a battery or connector yet).

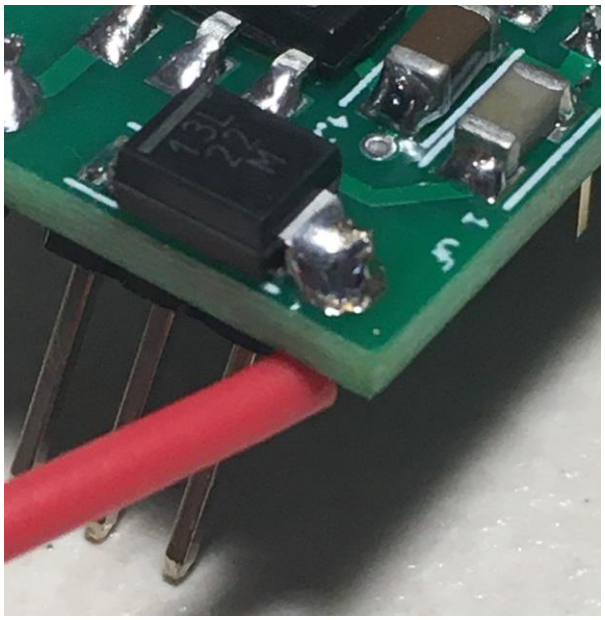
Solder your battery connector pigtail to the two pads near the edge of the board marked “+” and “-“. In general, the “+” side of the battery will be RED, and the “-“ side will be BLACK. If your pigtails are NOT these colors, you need to test them with a DMM first, to make sure which one is “+” and which one is “-“!

Make sure that there are no stray wire “whiskers” touching the board, particularly on the “-“ side since it’s relatively close to some other components.



__ Finish soldering the Diode

Now that the battery pigtail has been mounted, you can solder the side of the diode that does NOT have a stripe to the pad. This pad connects directly to the "+" battery lead, so if some solder bridges over to the "+" pad that's fine.



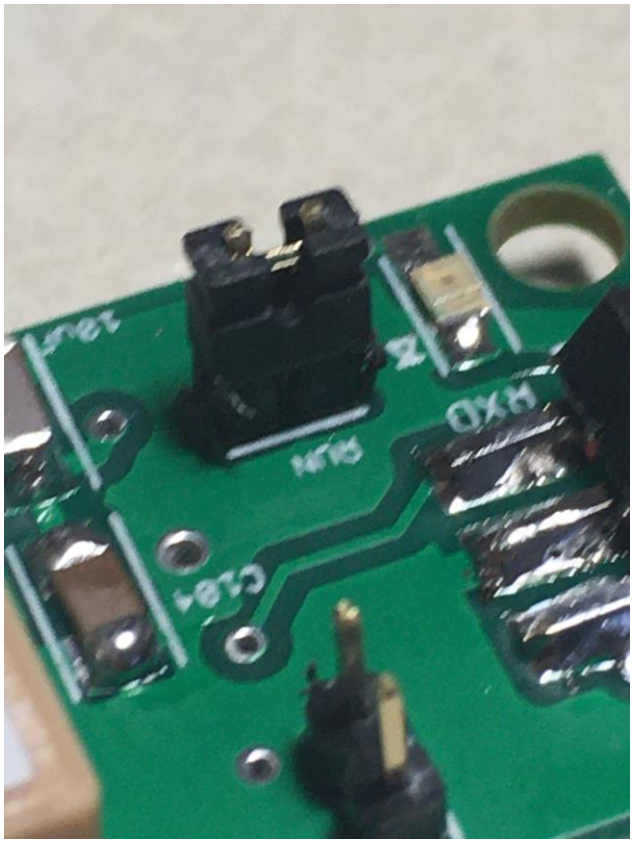
Afterwards, check the side of the diode with the stripe, and resolder if necessary.

Initial Testing

At this point, the components to support testing the GPS are mounted on the board. We strongly recommend at this point that you test the output of the GPS… it will be much harder to make any changes once the RF module is mounted. To do this, you'll need an Eggtimer USB-Serial cable, and either a serial terminal program or a serial GPS test program such as Visual GPS. We like to use Putty as our test serial terminal program… it's easy to use, and it's available for both Windows and Mac.

__ Connect the RUN jumper

Place the shorting jumper across the 2-pin header marked "RUN". You will need to have that jumper in place for normal operation; the only time you'll remove it is when you're programming the frequency/ID using the Eggfinder LCD receiver (at which time it will be moved to the "PGM" header.)



__ Connect the USB-Serial Cable and Test

Install a serial terminal program on your computer, such as Putty, or a serial-GPS program such as Visual GPS.

<u>For the older USB-Serial cable (blue headshell with 3-wires):</u>

If you don't have the driver for the USB-Serial cable, you'll need to get it from our web site under the Support tab. DO NOT use the one from either Windows or the Prolific web

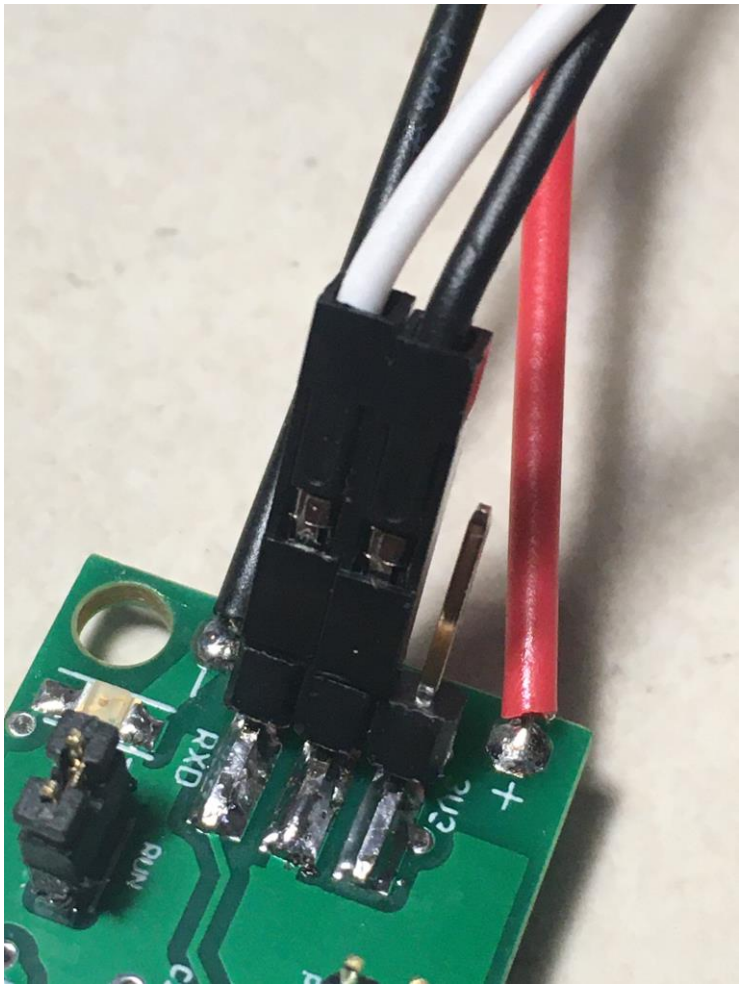
site… they will not work anymore. Also note that the cable will NOT work with Windows 11… you MUST get the newer USB-Serial "dongle" if you have Windows 11.

Connect the USB-Serial cable so that the BLACK (GND) wire is on the terminal marked GND, and the WHITE (RXD) wire is on the terminal marked RXD. The GREEN (TXD) wire should be left unconnected. DO NOT connect anything to the pin marked "3V3"!

For the newer USB-Serial "dongle":

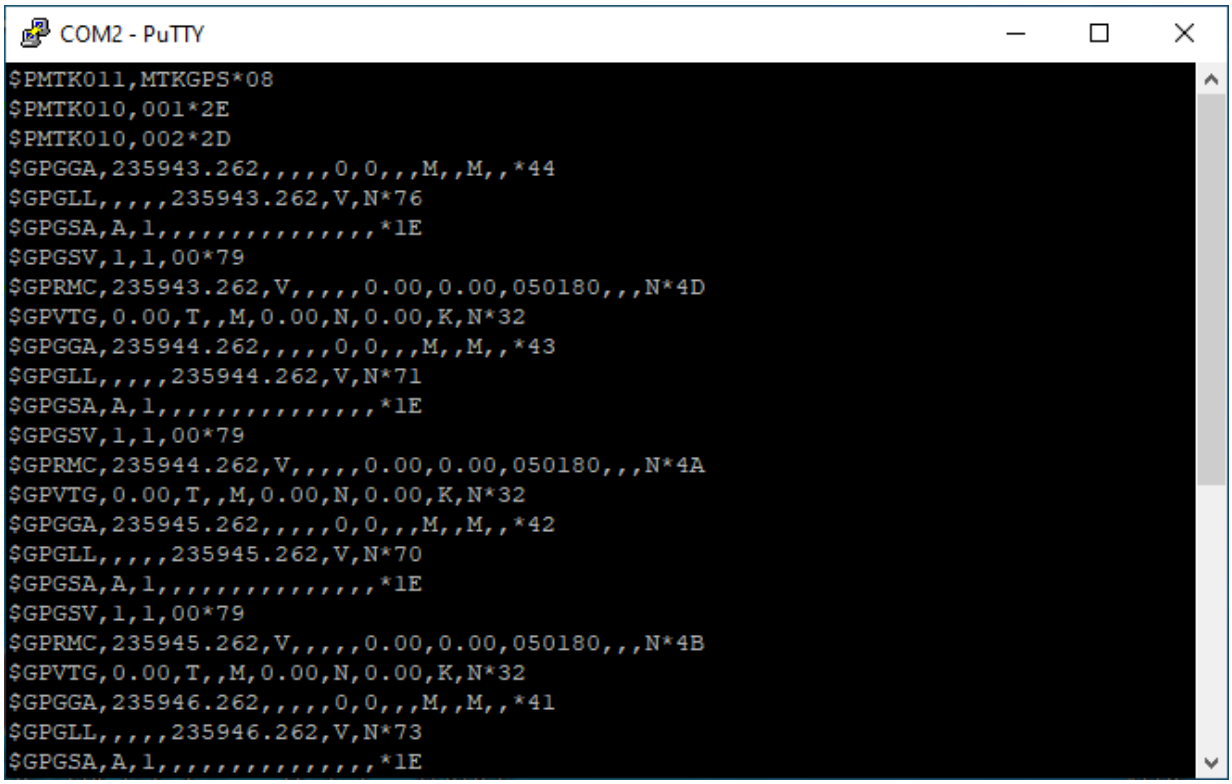
If you don't have the driver for the USB-Serial dongle, see the document on our Support page… it will tell you where to get the driver.

Connect the USB-Serial dongle so that the GND wire is on the terminal marked GND, and the RXD wire is on the terminal marked RXD. Do not connect any other wires between the USB-Serial dongle and the Mini!



Plug the USB-Serial cable into your computer, and start the terminal program… the settings should be 9600 baud, 8 bits, 1 stop bit, no parity.

Connect your battery to the Eggfinder Mini. You should immediately begin seeing readable data scrolling across the screen, with each line beginning with $GP.



If you see this, then congratulations… the GPS is working, and you can go on to mounting the RF module. Disconnect the battery and the cable.

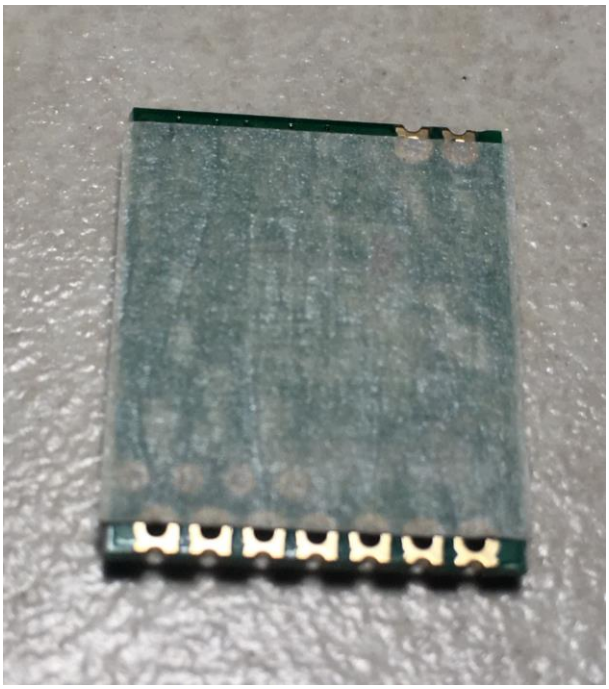
If you do NOT get the $GP… data scrolling across your screen, then either your program settings are incorrect, or you have an issue with something on the board. Disconnect the battery, unplug the USB-Serial cable, and inspect every solder joint carefully with a 10x jeweler's loupe.

Mounting the Hope RF Radio Module

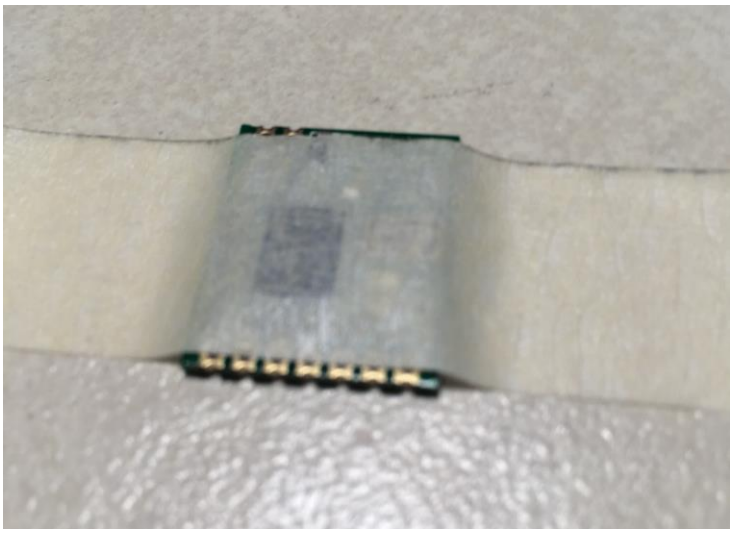
You will be surface-mounting the Hope RF radio module to the board, however it's a little different from the resistors and capacitors in that you'll be placing it on the board first, with no pre-tinning of the pads. The spacing between pads is relatively small, so it's important that you get the alignment correct… if you get a solder bridge between the pads, chances are pretty good that you will damage the module once you apply power. We made the pads narrower than the RF module's pads to help prevent solder bridges underneath them, but it's important that you use only enough solder to join the RF module to the PC board pads, oversoldering the pads can lead to bridges underneath the RF module pads.

__ Using a hobby vise or taping the board to your table, secure the board so that the side with the GPS module is DOWN (the RF module is up). You will be soldering the side of the RF module that has seven pads first, the other side with two pads will be handled later.

__ Cut a piece of ¾" masking tape about 2" long.. Cover the BOTTOM of the RF module with the tape, it should go just about between the center of the holes on the RF module's pads. Trim the tape with a hobby knife so that it's even with the sides of the module. This insulates the bottom of the RF module from the "vias" on the PC board, to prevent shorts.

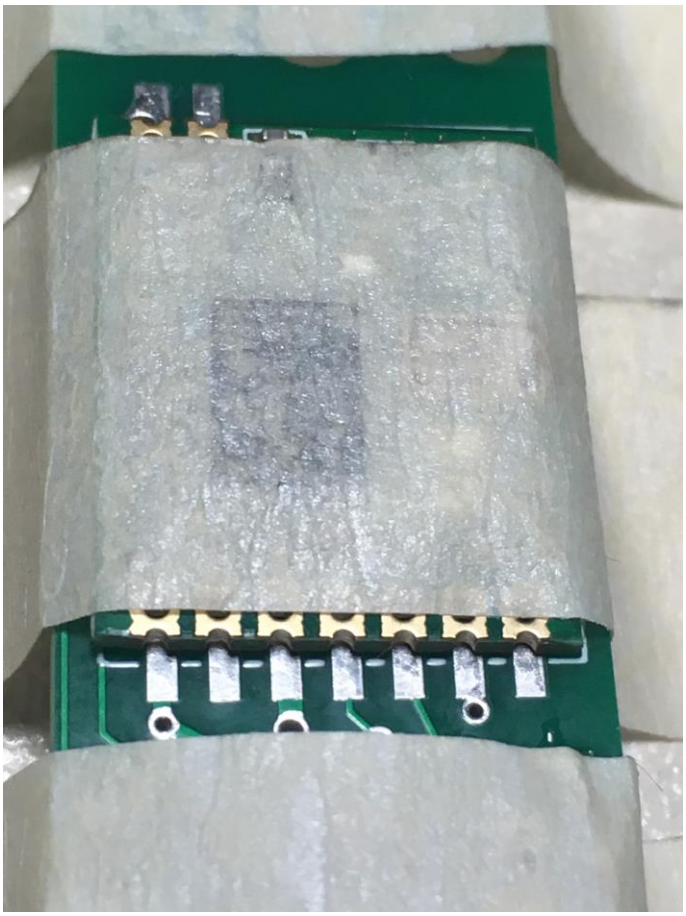


__ Cut another piece of ¾" masking tape about 3". Cover the TOP of the RF module with the tape, it should go just about between the center of the holes on the RF module's pads. This is to prevent any errant solder splatter from getting onto the RF module when you solder it, since the SMT parts on the module are exposed. There are some VERY tiny exposed parts on the RF module, if you get the tiniest bit of errant solder on the module chances are excellent that it will be ruined.

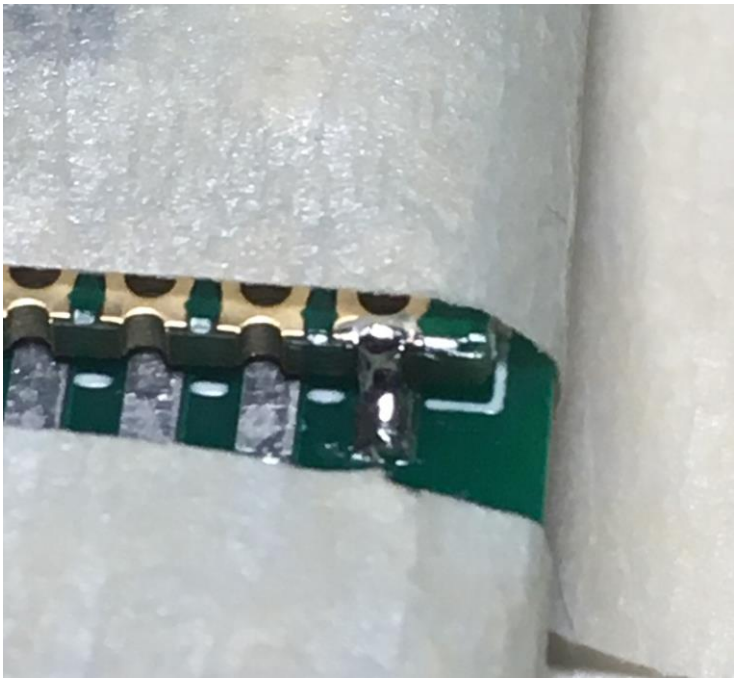


__ Carefully position the Hope RF module on the board so that its pads line up in the center of the top pads, the “half-moon” cutouts on the module should be centered on the pads on the board. Using the tape on the RF module, secure it in position.

__ Double-check the alignment. The “half-moon” cutouts on the end of the RF module pads should be squarely on the center of the PC board pads. If they are not, remove the module and reposition it until they are.



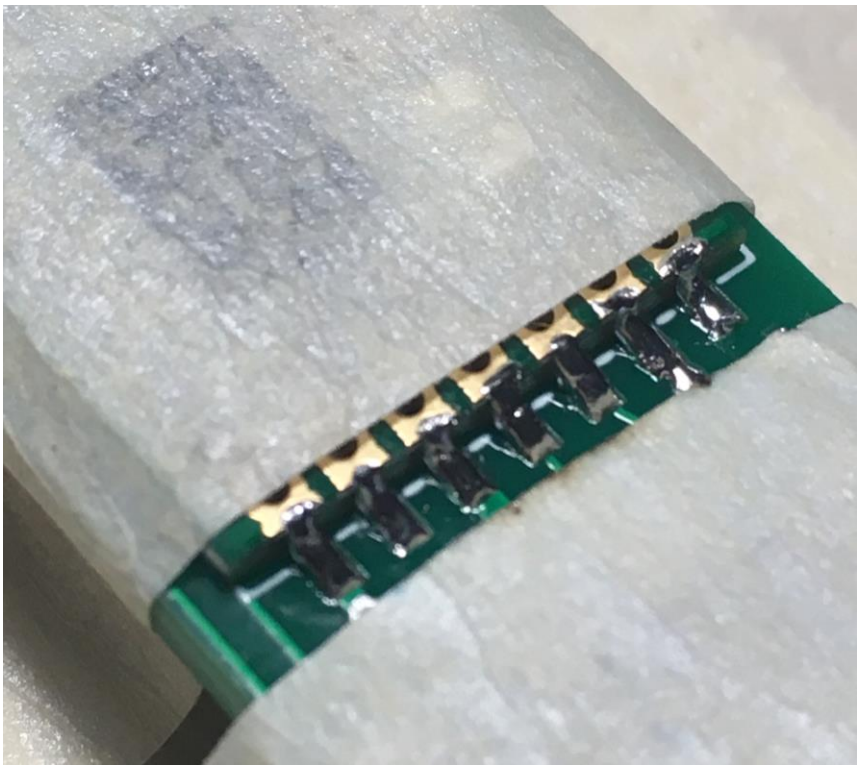
__ Solder the rightmost pad to the RF module. The best way to do this is to hold your iron to the pad for several seconds, then apply solder once the pad has heated up. The solder should flow onto the pad, and wick up to the RF module's "half-moon" pad. DO NOT OVERSOLDER! You do NOT need to get solder into the holes on the RF module pads; in fact, if you do that's a pretty good indicator that you're using too much solder.



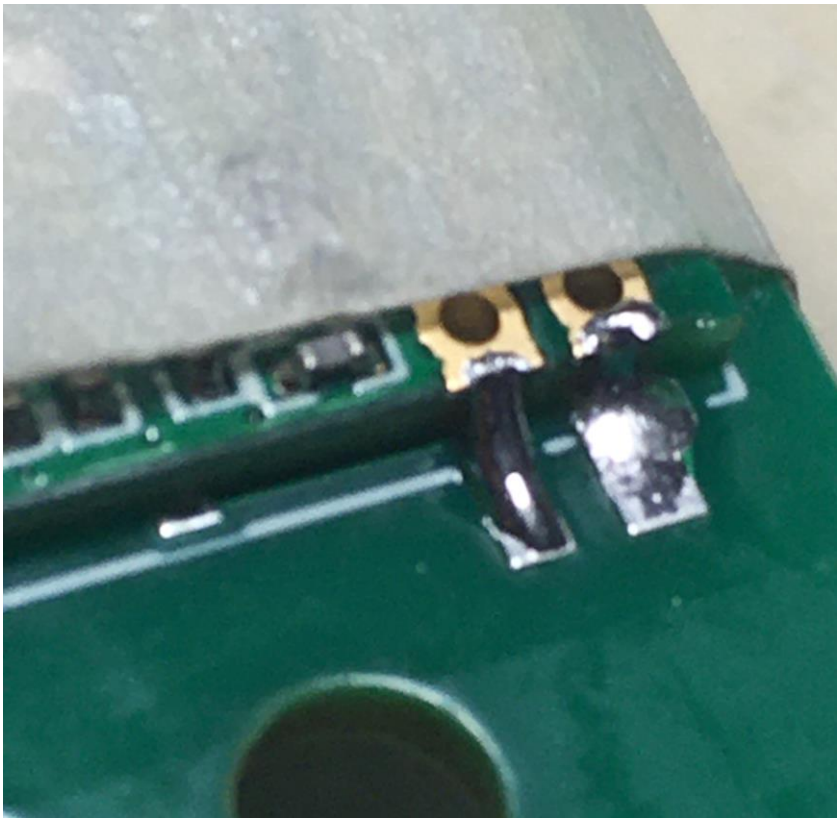
__ Inspect the pad that you just soldered with a 10x jeweler's loupe, there should be a nice fillet of solder between the "half-moon" pad on the RF module and the pad on the PC board.

__ Check the alignment of the RF module on the board, making sure that all of the pads on both ends of the RF module are still squarely on the pads. If not, you'll have to heat up the pad that you just soldered, remove the solder from the PC board with some desoldering wick, reposition the RF module, the resolder the pad.

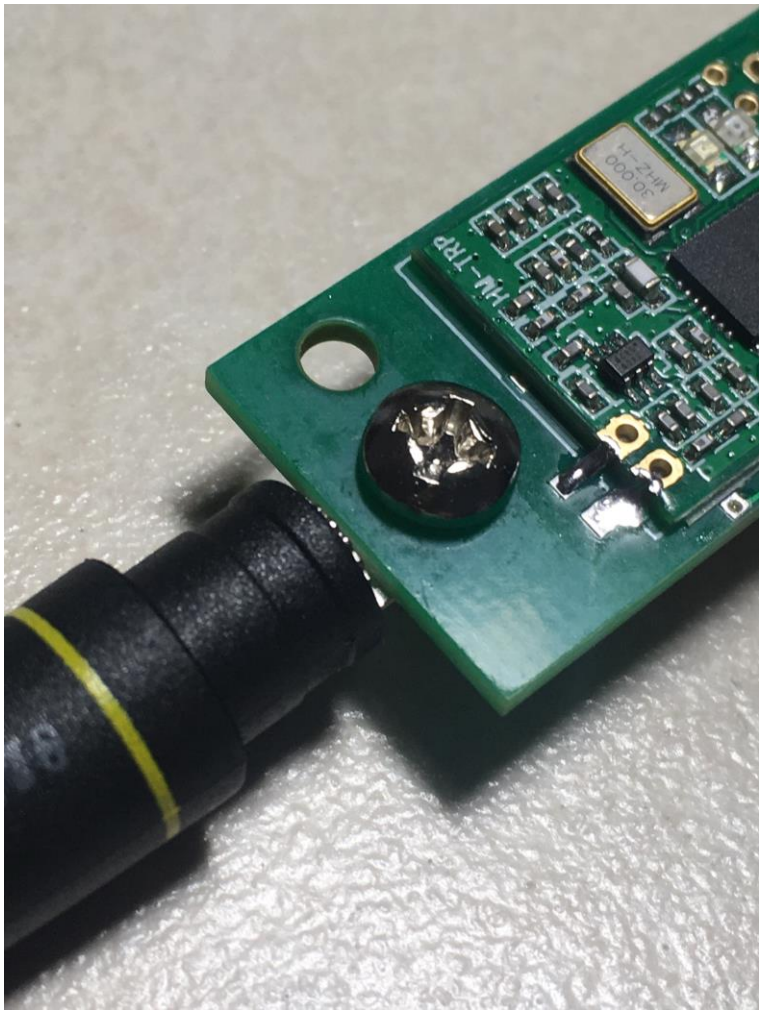
__ Solder the remaining six pads on that side of the RF module, waiting 30 seconds between pads to prevent overheating the module. Inspect every solder joint carefully with a 10x jeweler's loupe, there should be a nice fillet of solder between the "half-moon" pads on the RF module and the pads on the PC board.



__ Turn the board around, and solder the other two pads. Inspect every solder joint carefully with a 10x jeweler's loupe, there should be a nice fillet of solder between the "half-moon" pads on the RF module and the pads on the PC board.



__ Put the screw for the antenna through the RF module side of the board, and mount the antenna on the GPS side of the board. Note that the antenna's mount is offset a little bit, the larger side should go on the GPS module side of the board. Make sure that it's pointing straight, and that the screw is tight. If you wish, you can use some Loctite on the screw, the screw itself isn't the electrical connection to the antenna, it's the large exposed pad on the GPS module side.



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Assembly of your Eggfinder Mini is now complete. Inspect the board carefully, looking for "cold" solder joints or incomplete solder joints. Cold solder joints appear dull instead of shiny, and may appear as blobs of solder and not have the nice "wetting" of the pad that you will see with good joints. A magnifying light is good for checking the board. We do not recommend using flux remover or other cleaners on this board, as they may not be compatible with the no-clean flux in the solder.
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Powering your Eggfinder Mini

The Eggfinder Mini is designed to be used with a 1S/3.7V or 2S/7.4V LiPo battery, we recommend that you use one with a capacity of 300 mAH or larger. The Mini has a nominal working current draw of 70 mA during normal operation, however there may be startup peaks as high as 200 mA. We DO NOT recommend that you use a 9V alkaline battery to power your Eggfinder Mini… they do not put out enough sustained current, and will quickly drain. A 300 mAH 7.4V 2S LiPo is ideal, it's a little smaller and lighter than a 9V battery and will easily power your Eggfinder Mini for over 4 hours. If you have a big rocket and can afford a little more weight, a 800 mAH 2S LiPo will run your Eggfinder for the whole flying day, which can be handy for those times when your main parachute comes out at apogee and your rocket drifts several miles away. (Yes, we've done that…)

Since the Eggfinder Mini lends itself towards temporary mounting (such as in an 18mm body tube or being put into a piece of Kevlar shock cord protector sleeve) and being put into really skinny rockets, you may want to use a smaller battery. If you have a 38mm minimum-diameter rocket, a 200 mAH LiPo works fine, and it's quite small. We've also seen some 300 mAH batteries that are relatively small, and actually fit in an 18mm tube.

We do not include a battery connection cable because there are several different ones that you may use, depending on your battery. Most 2S LiPo batteries have a "JST" connector, so it is very common to use a JST-RCY female "pigtail" on the board. There are also some 1S batteries that use JST connectors, although

Since the Eggfinder Mini is turned "on" by connecting the battery, there's really no reason for a power switch, as long as you have a removable battery connector. It's desirable to keep it powered up, since that will maintain the satellite "fix"; the location of the satellites is volatile, and is erased when you removed the power. See the Eggfinder User's Guide (in the Eggtimer Rocketry web site, www.EggfinderRocketry.com) for tips on using it in flight. If you're using the Eggfinder LCD receiver (which we HIGHLY recommend), see the Eggfinder LCD User's Guide… everything that applies to the Eggfinder TX also applies to the Mini, including the frequency programming section.

Testing Your Eggfinder Mini With An Eggfinder Receiver

To test your Eggfinder Mini, first connect the battery. The red light on the RF module should immediately start blinking, about once per second.. **(If it does not, immediately unplug the battery and go to the Troubleshooting section).** The GPS module begins its startup sequence, and causes it to start looking for satellites. The GPS module will begin transmitting status data immediately, you should see the small red LED on the RF module blinking approximately once per second as the data is sent out. It will take anywhere from 30 seconds to a few minutes for the GPS to acquire enough satellites to begin sending out valid latitude and longitude data, when that happens the 1S (AMBER) light will begin flashing on and off once per second. Once that happens, get out your Eggfinder receiver and make sure you can get a fix. Note that you must test outdoors… it's not very likely that you will get a fix indoors from a cold start.

If you don't have your Eggfinder receiver built yet, build it and come back…

If you do, turn it on, set it to 915 MHz/ID=0 (or if you have an International version, whatever the default frequency/ID is for that region), and see if you get a fix. If the orange LED on the Eggfinder Mini is blinking, you should see a fix on the LCD receiver almost immediately. If it's not, you'll probably see the green light on the LCD receiver's RF module blinking, and the LCD display will say "Waiting for Fix". Be patient… it may take a few minutes for the Eggfinder Mini to pick up enough satellite signal to get a fix.

If you DO get a fix, congratulations! You're done. There's one more step we recommend, though…

Troubleshooting

If your Eggfinder Mini 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. 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. This is particularly true with the RF module. 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. Also, the pads on the RF module are small, so you want to make sure that you got just enough solder on them to bond the module to the pads. Most of 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 splatter will almost always cause more damage than the original solder bridge, and if you get solder splatter on the RF module, there's no way to fix it.

Another thing to look out for is "cold" solder joints, they look dull and blobby compared to a nice shiny "tented" solder joint. If you have a cold solder joint, it won't conduct well; at the low power that the Eggfinder Mini 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 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.

If the amber LED is backwards, the little red LED on the RF module will blink, but the amber LED will never come on.

Similarly, if you get the diode backwards, the board won't work at all. Be sure to match up the stripe.

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 Eggfinder 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.

Check Your Power Supply

Make sure that you are using one of the recommended batteries to test with. Use a freshly-charged 1S/3.7V or 2S/7.4V LiPo battery. We do not recommend using a 9V battery… even for testing, they are designed for sustained "trickle" loads like a smoke detector, and don't work very well for higher-current loads.

If It Still Doesn't Work…

There is, of course, always an outside chance that you have a bad component. We test each PC board and the surface mounted components before they leave us. 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)

RED LED on the RF Module Doesn't Blink at Power-Up

- Solder bridge on RF module pads
- Bad solder joint on the capacitors next to GPS module
- Missing/loose shorting jumper on the RUN header
- Bad solder joint on battery connector pads
- Bad solder joint on voltage regulator
- Backwards diode
- Solder bridge "somewhere" on the board… time to go hunting with a lighted magnifier

AMBER LED doesn't flash, but RED LED on RF module is flashing

- Very weak GPS signal, try it outdoors
- Few satellites in view, let it run for about 30 minutes
- Bad solder joint and/or bridge on the capacitors
- Amber LED is backwards
- Bad solder joint and/or bridge on Amber LED
- Bad solder joint and/or bridge on 330 ohm resistor

Can't Get a Fix on the Receiver but Amber LED blinks and red LED on the RF Module blinks

- Very weak GPS signal, try it outdoors
- Few satellites in view, let it run for about 30 minutes
- Receiver frequency/ID doesn't match
  (Is the green LED on the receiver's RF module blinking? If not, they're not matched!)

Programming the Frequency on your Eggfinder Mini

Eggfinder Mini's are shipped with a default frequency of 915 MHz (unless you specified otherwise when you ordered it, or it's an EU/UK or AUS/NZ version). You can change the frequency of your Eggfinder Mini so that if you find that other flyers are using the same frequency there isn't a conflict. To do this, you'll need an Eggfinder LCD Receiver. There are a total of 9 base frequencies and 8 ID codes to choose from, so up to 72 Eggfinders can be running at the same time.

We STRONGLY recommend that if you do nothing else, you change your Eggfinder Mini from the default frequency (matching your receiver), since if you do not there is a good chance that somebody else will have one on "your" frequency, particularly at a very large launch.

Changing the frequency on the Eggfinder Mini is easy, there's no soldering required, but you probably still won't want to do it in the field… you should do it BEFORE you go out to fly, and test it at home first.

To change the frequency:

• Remove the jumper from the "RUN" header, and move it to the "PGM" header.

• Do NOT connect a battery to the Eggfinder Mini… it will get its power from the LCD receiver.

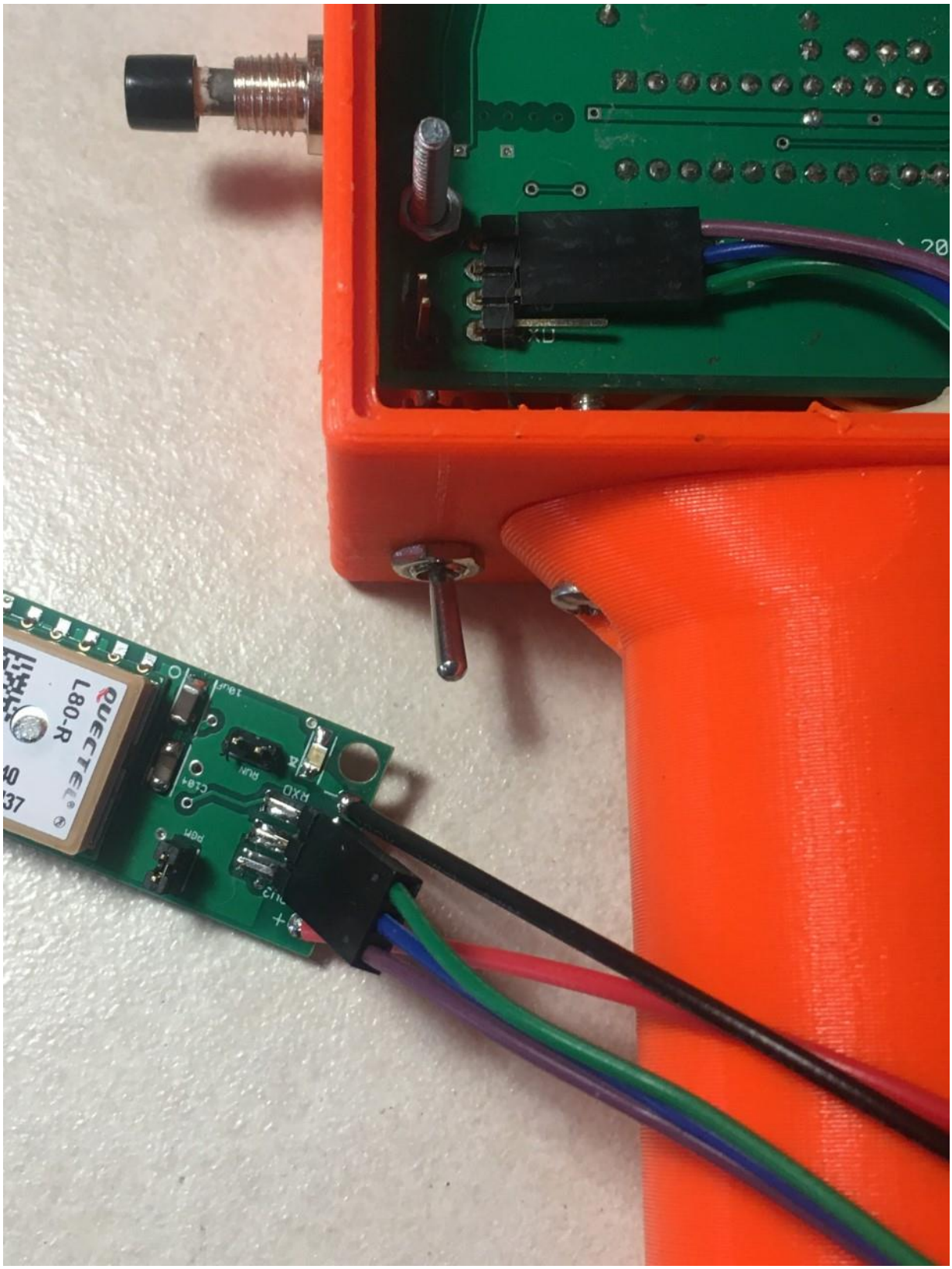
• Open up the case on your LCD receiver, and make sure the power is OFF.

• Connect the programming cable to the Mini & the LCD receiver…

Plug the 3-pin programming cable into the 4-pin header on the LCD receiver, so that the 3.3V, GND, and TXD pins are connected. Those are the TOP THREE PINS of the 4-pin connector; the bottom pin will not be connected.

Plug the other end of the cable into the Mini's header, MAKING SURE THAT THE 3 WIRES ARE CONNECTED TO THE SAME PINS ON BOTH THE MINI AND THE LCD. DOUBLE-CHECK BEFORE CONTINUING! Make sure that you match the color of the 3.3V wire on the LCD receiver to the 3.3V pin on the Mini's header, and you'll be fine.

See the picture below.



• Turn on the LCD receiver's power… the Mini should also come on with BOTH the RED and GREEN LED's on the RF module lighting up. If it does NOT come on like this, immediately turn off the LCD's power and check your connections.

• At the LCD's status display, hold the button down for 3 seconds then release it to put it into programming mode.

• Follow the frequency programming instructions found in the Eggfinder LCD Receiver User's Guide. When you program the frequency on the LCD receiver, the Eggfinder Mini that's connected to it will also be programmed to the same frequency and ID code.

• Turn off the LCD receiver, disconnect the programming cable from the LCD and the Mini.

• Move the jumper on the Mini from the "PGM" header to the "RUN" header.

• Power on the Mini, the RED LED on its RF module should start immediately blinking.

• Power on the LCD receiver, the GREEN LED on its RF module should start blinking in sync with the RED LED on the Mini. This means that they are now on the same frequency/ID.

• Wait a few minutes until you get a fix to confirm that everything is working before flying. . We recommend that you test it outdoors if possible, preferably away from buildings… if you're testing indoors, it may take a long time to get a fix, or you may not get one at all.

Shockproofing Your Eggfinder Mini

The Eggfinder Mini is small and light and can take quite a beating from things like hard landings and VMax motors, however there is one component that is vulnerable… the GPS antenna, that brown square on top of the module. With a strong enough shock, it can break off from its base. We STRONGLY recommend that you glue it down to the metal shield using a thin bead of a high-quality non-conductive epoxy like RocketPoxy or West Systems. Don't use the cheap hardware store epoxy, and DO NOT use JB Weld… it contains metal particles and can detune the GPS antenna and reduce its performance. It doesn't take much, a couple of drops of epoxy spread between the base of the antenna and the shield should do it. You should glue the sides that do NOT have the solder pads… we recommend that you do not epoxy over the PC board pads. A round toothpick works great for laying just the right size fillet.

We also recommend that if you're putting your Eggfinder Mini in a pouch that you zip-tie the power wires to the unused screw mount at the back of the board, and use some kind of soft adhesive (such as RTV silicone or hot melt glue) to tack the wires to the pads so they won't get bent and break off due to stress. Masking tape also works fine for this.