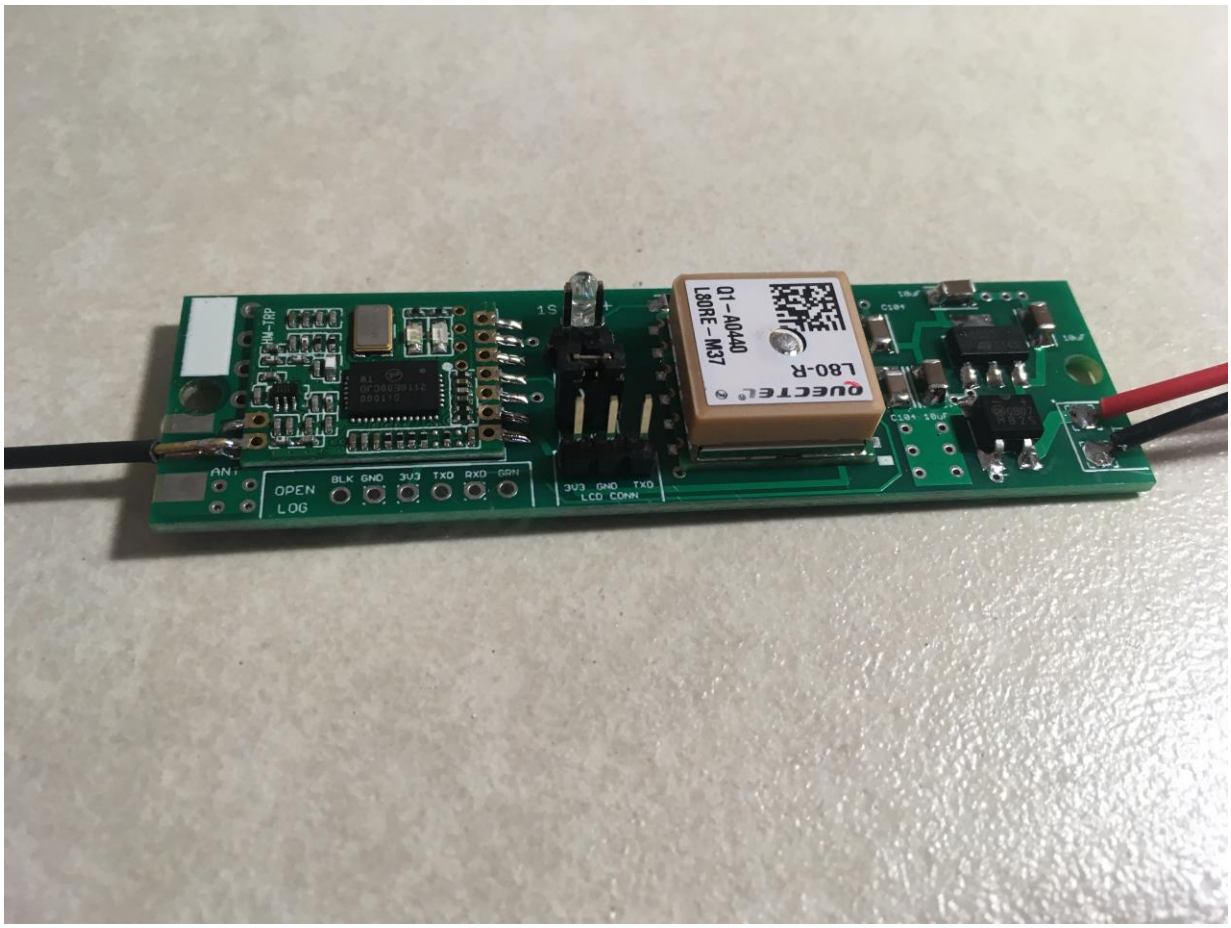
Eggfinder TX
Assembly Manual

TX Board Rev D3/D4



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

The European Union RoHS (Restriction on Hazardous Substances) regulations exempt kits such as the Eggfinder from its regulations, because they are not for resale and since it is well known that hand soldering with non-leaded solder is much more difficult and more damaging to heat-sensitive components.

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 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 we recommend in the instructions, or a suitable replacement as outlined in the Appendix.

Because the Eggfinder 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 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 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 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…

• If you bought an Eggfinder Starter Set (both Eggfinder TX transmitter and RX "dongle" receiver kits), make sure that both of them are on the same frequency/ID (it's marked on the package label). If they are not, do not open the kits; contact us immediately so we can send you a replacement kit and a no-charge return label. If you purchased the Eggfinder LCD receiver, the package won't be marked… they're shipped at the default frequency/ID (915/0) and you can (and should!) change them after you've assembled them.

• 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 TX GPS Tracker! The Eggfinder TX 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 computer or tablet. With appropriate GPS tracking software, which is available for free on the Internet, you can actually track your rocket in flight, and ultimately find out exactly where it landed. You can also use the Eggfinder LCD handheld receiver to get the GPS coordinates, and with the optional LCD-GPS it will tell you which way to go and how far to go to retrieve your rocket. If you get the optional Voice Module, it will literally "tell" you where to go… great for those long recoveries where you may have to drive to it.

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!).

About Soldering Your Eggfinder…

Assembling your Eggfinder TX 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 TX uses mostly Surface Mount Technology (SMT) parts, but they are large by SMT standards, and are within the realm of being hand-solderable. In order to help make your assembly successful, we have included some very fine (.020"), very low temperature (about 180°C), no-residue solder. This is not the stuff that you get at Radio Shack… it's designed for soldering small temperature-sensitive parts without transferring much heat to the part itself.

Important note 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. A few drops will suffice for the entire board. 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 TX, 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. A good choice is the Hakko FX888D, it's about $100 will probably be the last soldering station you ever buy. Get the right tip… we recommend a 1/32"/0.8mm conical tip. It should be just about the same width as the RF 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 (1/32", 0.8mm)

___ Small needle-nose pliers

___ Small diagonal cutters

___ Tweezers to handle the SMT parts

___ A tinning block and a brass mesh "sponge" for cleaning your iron's tip

___ 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 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.

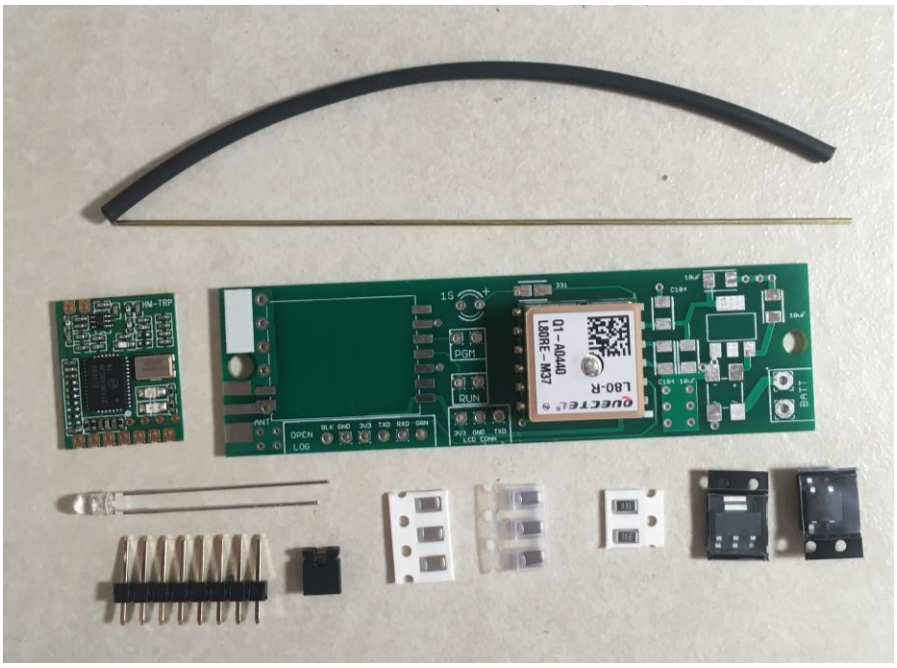
We strongly recommend that you consult the assembly pictures as you go, so you can see exactly what the parts look like and where they go. Looking at the pictures as you go will help prevent you from soldering the wrong thing, or putting something in the wrong way.

Assembling your Eggfinder TX 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	LD1117-33 3.3V voltage regulator
__	1	B4S Full-Wave bridge rectifier
__	1	3mm Amber LED (it may be clear)
__	1	330 ohm 1206-sized resistor (marked “331” or “3300”)
__	2	0.1 uF 1206-sized capacitor (brown part in PAPER tape)
__	3	10 uF 1206-sized capacitors (brown, unmarked)
__	1	8-pin header strip
__	1	2-pin shorting jumper
__	1	1/32” Brass Antenna Wire (4”)
__	1	4” length of 1/16” heat-shrink tubing
__	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 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, 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 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 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 TX 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 TX in the order listed. This makes it easier to access the surface-mount components, if you start soldering out of order it's going to be tough for you to get to the pads of the SMT parts. Some of the instructions 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 Limited Warranty does not cover damage to parts while attempting to desolder them because you inserted something incorrectly. We spent a lot of time making sure that the assembly instructions were clear, but once again if you have any questions about the assembly procedures drop us a line at support@eggtimerrockety.com ***before*** you solder.

OK, so let's get started…

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 the part where you want it, touch the tip of the soldering iron to the pad until the solder melts.

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

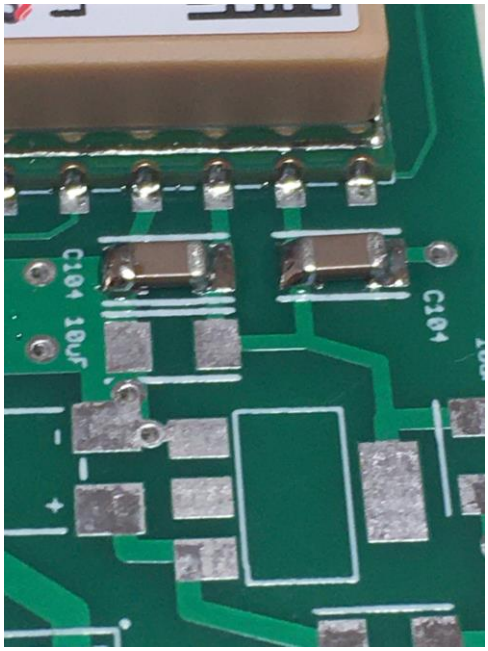
5) Wait about 5 seconds then let go of the part.

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 almost immediately. 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 heat/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.

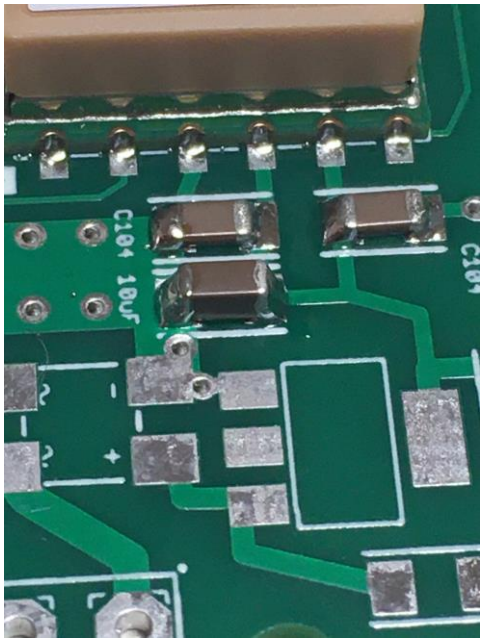
___ Mount the 0.1 uF capacitors

Locate the two 0.1 uF capacitors, next to the GPS module, they're marked "C104" on the PC board. Remove two 0.1 uF capacitors from the tape, they're in a PAPER tape with no markings. Per the procedure, mount them to the board.



___ Mount the 10 uF capacitor

Locate the spot for a 10 uF capacitor, right next to the leftmost 0.1 uF capacitor that you just mounted. Remove a 10 uF capacitor from the tape, it's a CLEAR tape with no markings. Mount the 10 uF capacitor onto the pads.

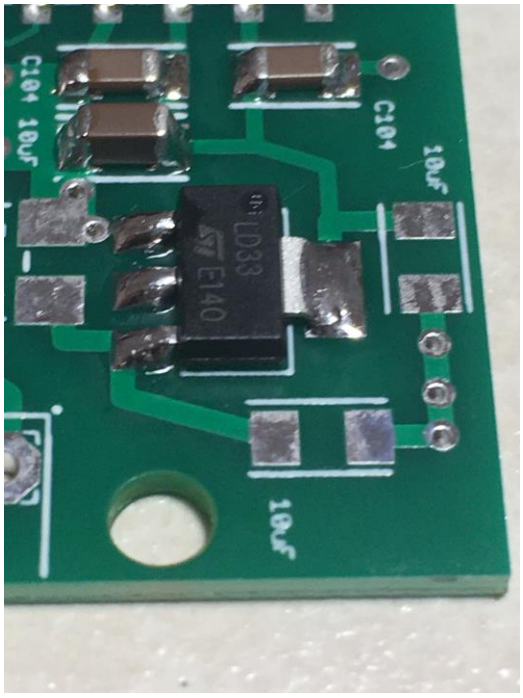


___ Mount the Voltage Regulator

Locate the large pad and the three small pads for the voltage regulator. Heat up the 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, but 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.

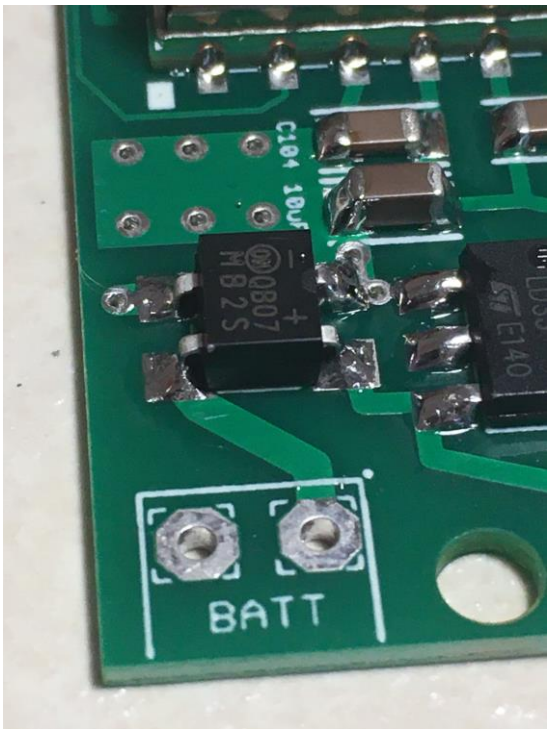


___ Mount the Bridge Rectifier

Unpack the bridge rectifier from its package, if you look at it closely you'll see that it has two AC pads (marked "~", or they may be unmarked) and the other side is marked "+" and "-".

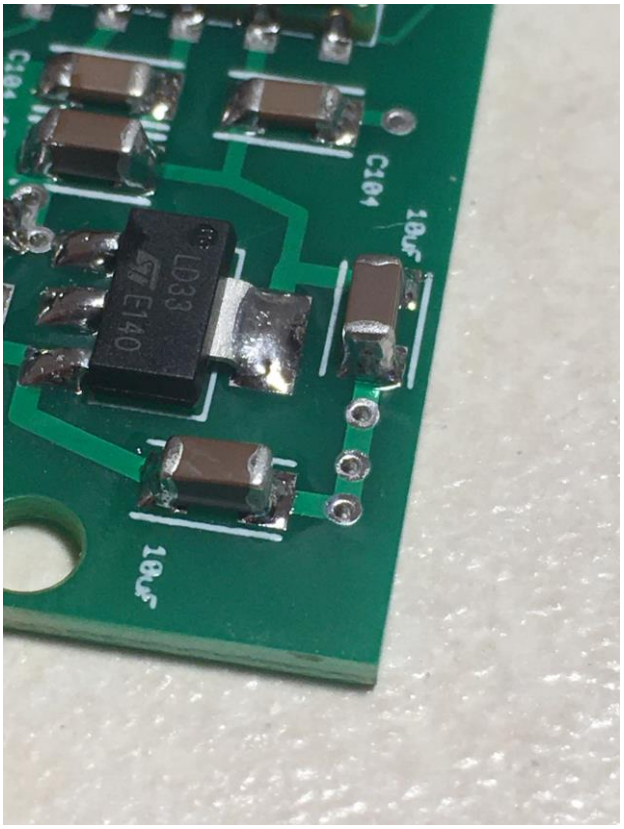
Tin the lower-right rectifier pad. With tweezers, hold the rectifier in place so that the "~" side faces the edge of the board; the "+" and "-" should be facing the voltage regulator with the "+" and "-" matching the markings on the board. Heat up the pad until the solder melts and hold the rectifier to the pad, hold the soldering itron for a few seconds to get a good joint, then remove the heat. Wait another 5 seconds before letting go of the tweezers.

Solder the other 3 joints, waiting about 15 seconds between each joint so you don't overheat the rectifier.



___ Mount the 10 uF capacitors

Mount the two 10 uF capacitors onto the pads next to the voltage regulator. One is just to the right of the regulator, and one is just below it.

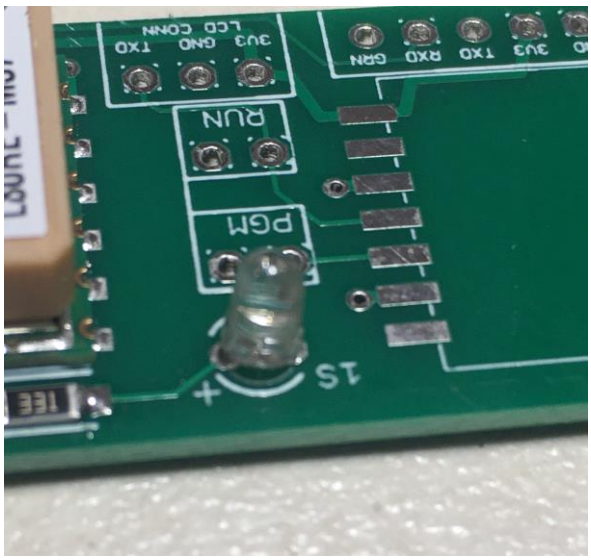


___ Mount the 330 ohm Resistor (marked “331” or “3300”)

Locate the 330 ohm resistor on the board, just to the right of the GPS module and near the long edge of the board. Solder into place.

___ Mount the AMBER (1S) LED

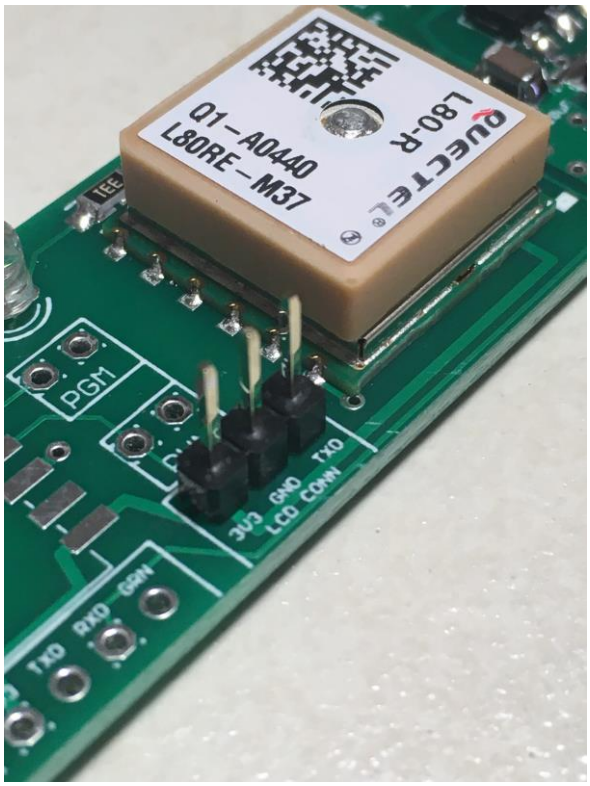
Insert the AMBER LED into the holes for the 1S LED, make sure that the LONG lead is in the hole maked “+”. Note that it may actually be clear. Turn the board over and solder the leads to the board. Trim the leads flush.



___ Mounting the 3-pin Header

With a pair of needle-nose pliers, break three pins off from the 8-pin header strip.

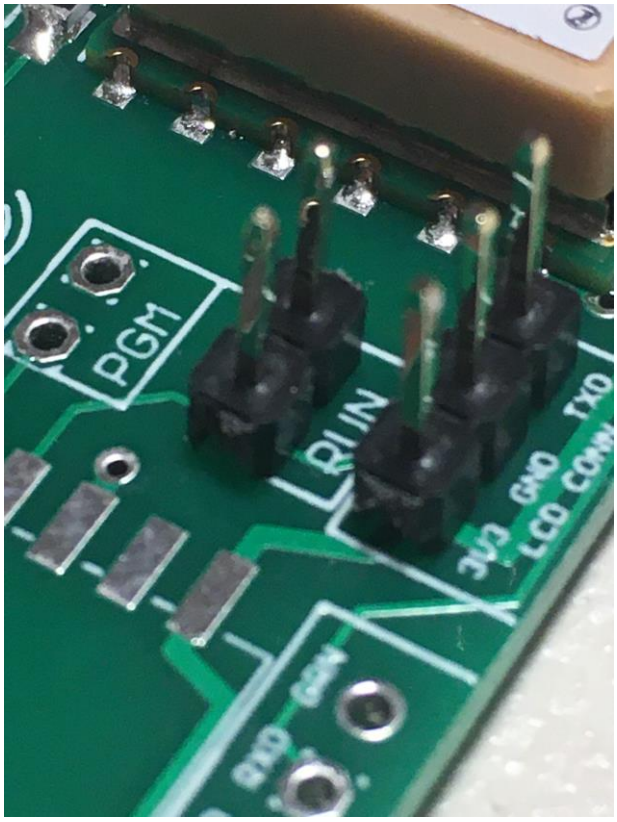
Locate the spot for the 3-pin header, it's marked "LCD CONN". Place the 3-pin header into the pads, short side through the board, then tape it into place so it can't move. Turn the board over and solder the three pads.



___ Mounting the 2-pin RUN Header

With a pair of needle-nose pliers, break two pins off from the remaining 5-pin header strip.

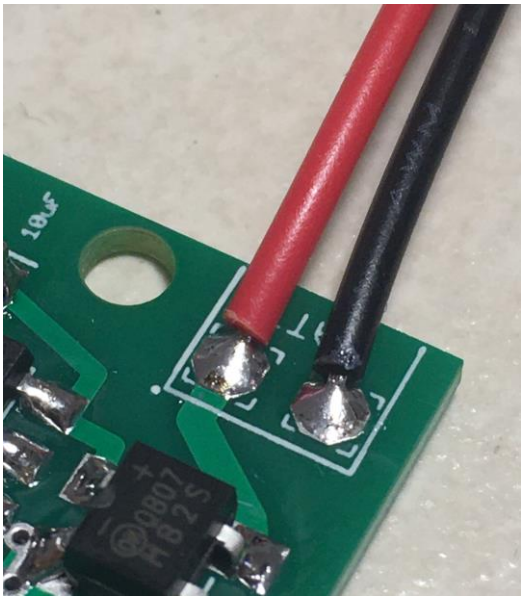
Locate the spot for the 2-pin header marked "RUN". Place the 2-pin header into the pads, short side through the board, then tape it into place so it can't move. Turn the board over and solder the two pads.



__ Solder the Battery Connector

(See the discussion on powering your Eggfinder TX 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 "BATT". There is no polarity on the board… the bridge rectifier makes either direction work.

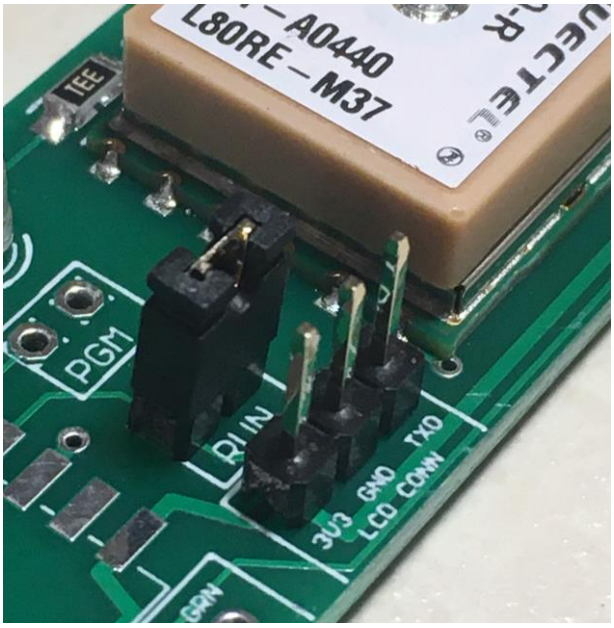


Initial Testing

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.)



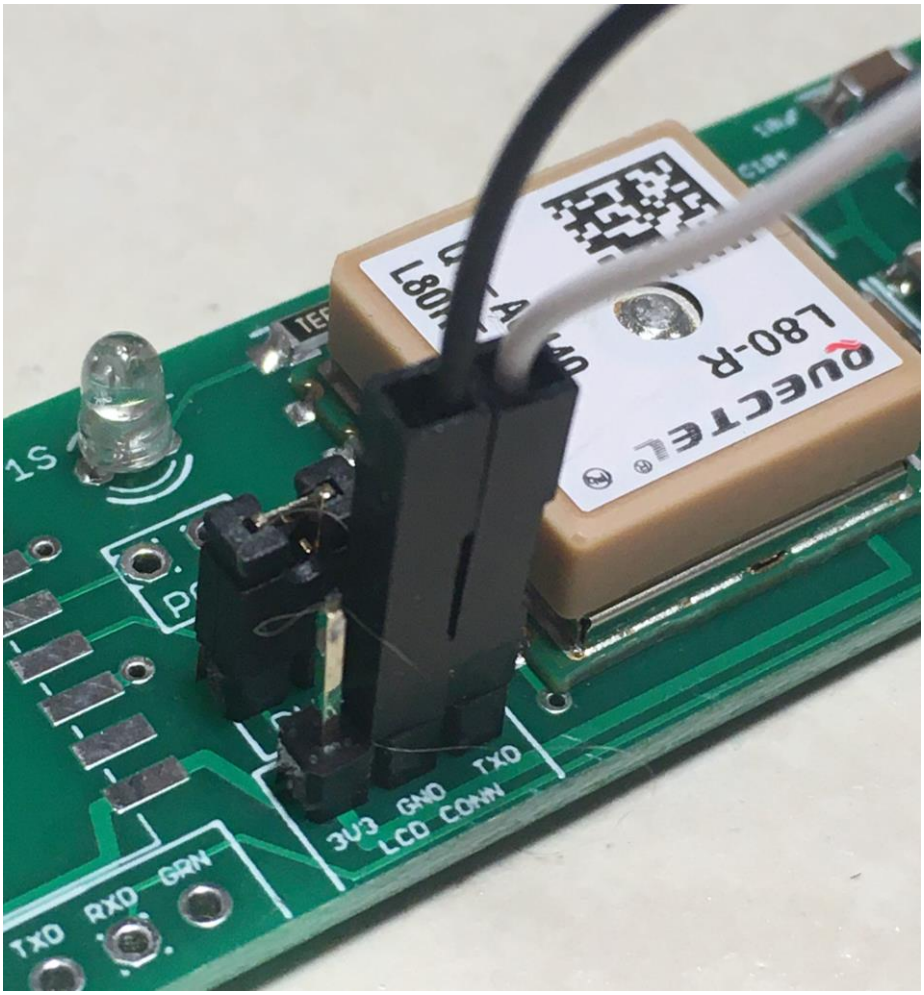
__ Install the Supporting Software

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

If you don't have the driver for the USB-Serial cable, you'll need to get it from the Prolific web site (Google "prolific pl2303 drivers"). Pick the one for the PL2303TA bridge chip. Install it per the normal driver installation procedure for your platform.

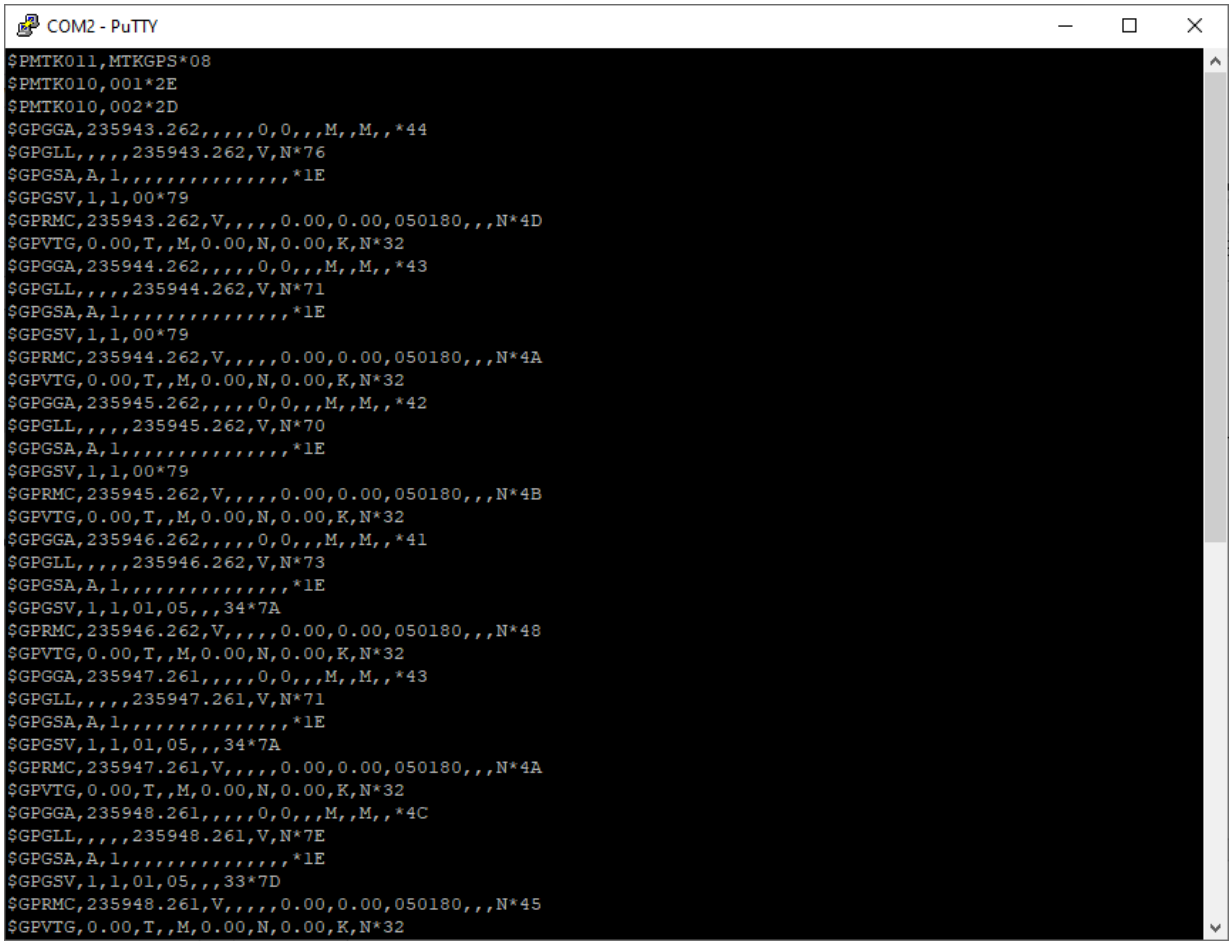
___ Connect the USB-Serial Cable

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 on the cable should be left unconnected. DO NOT connect anything to the third pin, the one that's marked "3V3". See the picture below.



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

Connect your battery to the Eggfinder TX. You should immediately begin seeing readable data scrolling across the screen, with each line beginning with $GP. It should look something like the screen shot below.



If you see this, then congratulations… the GPS is working, and you can go on to mounting the RF module. Disconnect the battery, the cable, and remove the jumper on the RUN pins… you'll put it back later after you mount the RF module.

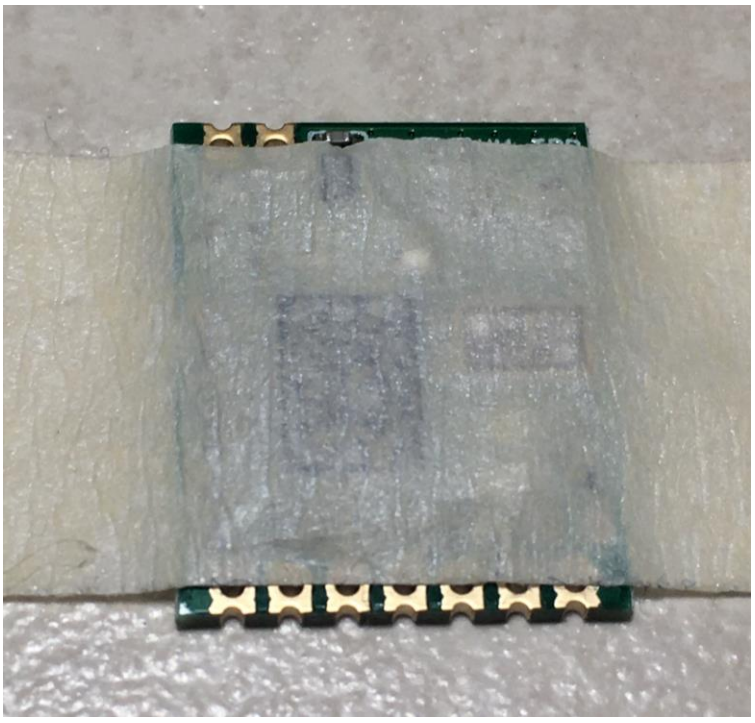
If you do NOT get the $GP… data scrolling across your screen, then either your program settings are incorrect, or you have an issue with something on the board. Disconnect the battery, unplug the USB-Serial cable, and inspect every solder joint carefully with a 10x jeweler's loupe.

Mounting the Hope RF Radio Module

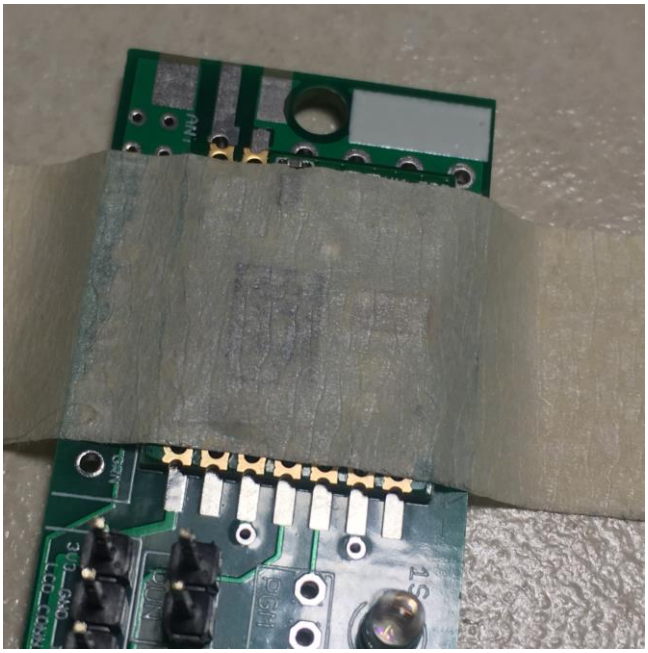
You will be surface-mounting the Hope RF radio module to the board, however it's a little different from the resistors and capacitors in that you'll be placing it on the board first, with no pre-tinning of the pads. The spacing between pads is relatively small, so it's important that you get the alignment 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 which will almost certainly damage the RF module.

__ Using a hobby vise or taping the board to your table, secure the board. 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. If you're using tape, tape it down on the side of the board with the voltage regulator on it, since you're going to be soldering to the RF module side.

__ Cut a piece of ¾" masking tape about 3" long. 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, 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.

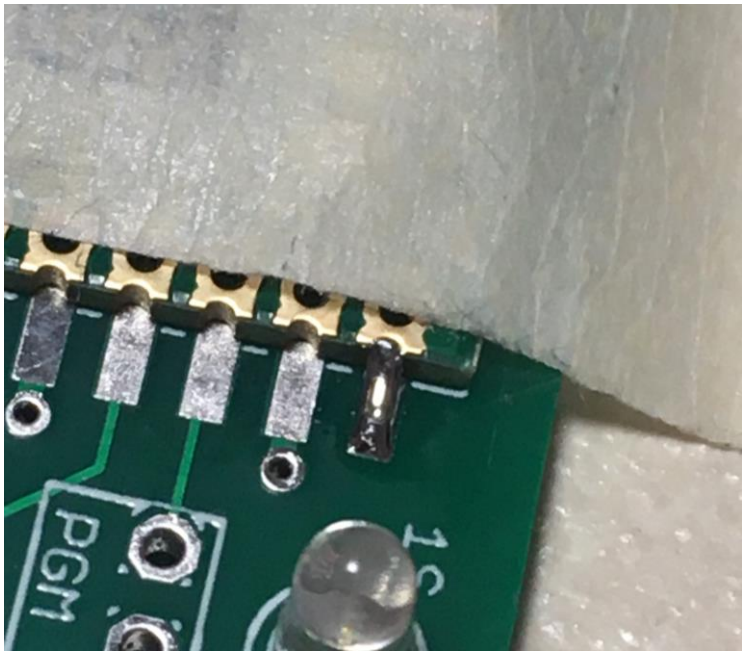


__ Carefully position the Hope RF module on the board so that its pads line up in the center of the top pads, the "half-moon" cutouts on the module should be centered on the pads on the board. Using the tape on the RF module, secure it in position.



__ 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, on both ends of the RF module. If they are not, remove the module and reposition it until they are.

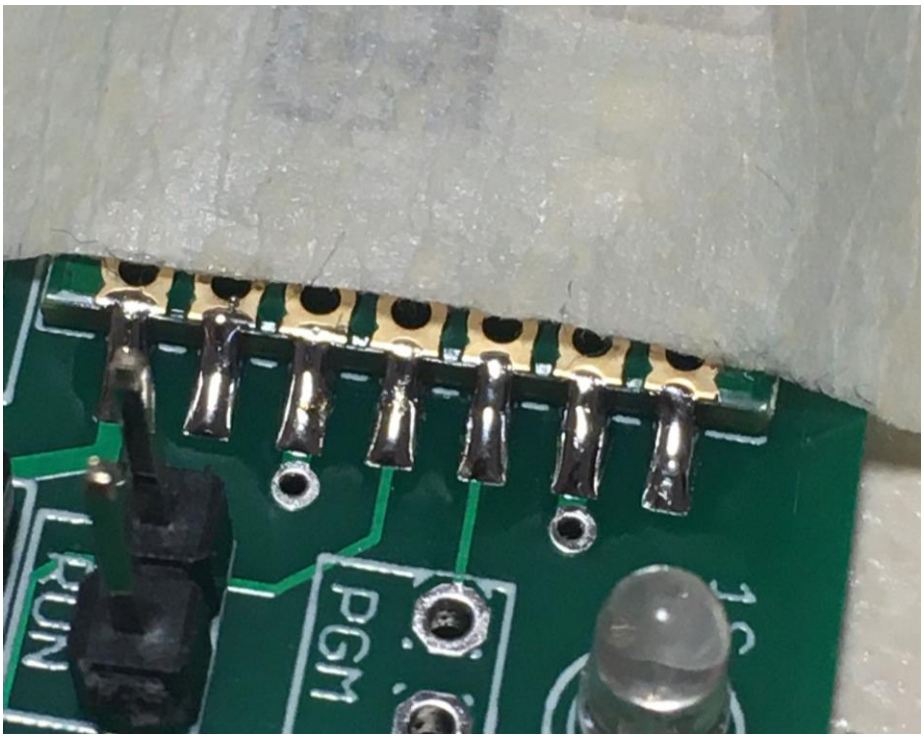
__ Solder the rightmost pad to the RF module. The best way to do this is to hold your iron to the pad for several seconds, then apply solder once the pad has heated up. The solder should flow onto the pad, and wick up to the RF module’s “half-moon” pad. DO NOT OVERSOLDER! You do NOT need to get solder 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.



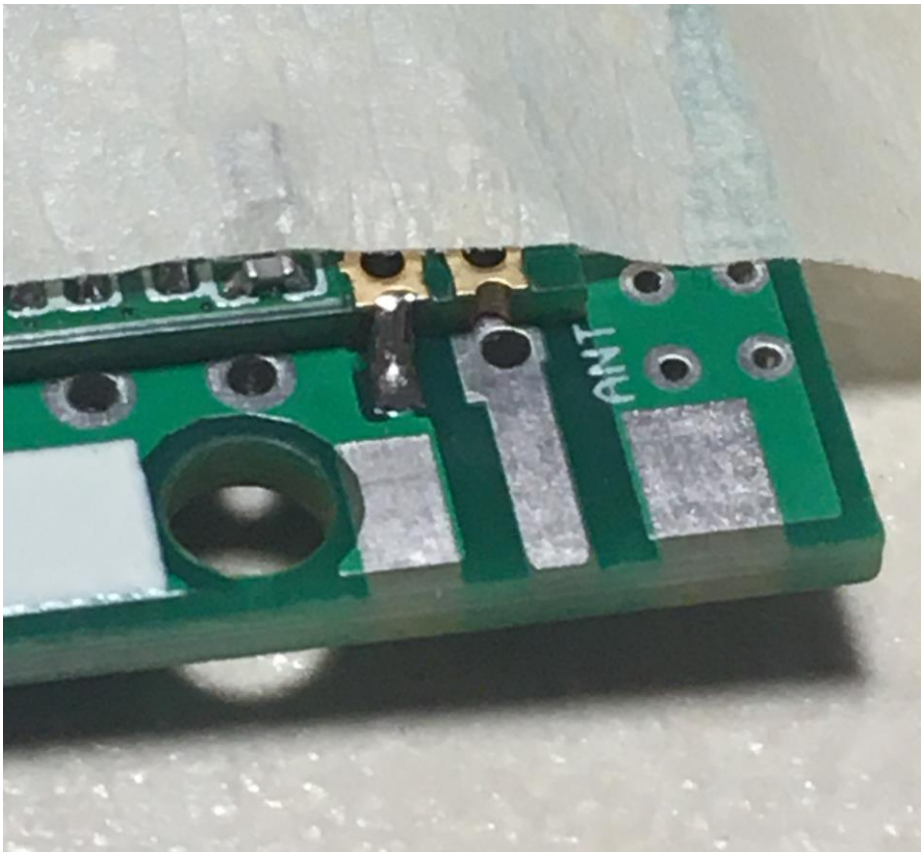
__ Inspect the pad that you just soldered with a 10x jeweler’s loupe, there should be a nice fillet of solder between the “half-moon” pad on the RF module and the pad on the PC board.

__ 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. Be careful not to get any solder on the header pins that you installed previously. 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 pad that is NOT marked "ANT". Inspect the 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.



__ DO NOT solder the pad marked “ANT” at this time… you’ll solder it when you mount either the wire antenna or the RP-SMA connector. Leave the tape over the RF module for now, too.

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Assembly of your Eggfinder TX is now almost 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.

Eggfinder Antenna Options

The Eggfinder has pads for either a permanent “stick” antenna or a RP-SMA edge connector for a removable/remote antenna. Your choice of antenna will depend largely on your rocket, and how much range you need.

The standard Eggfinder TX ¼ wave “stick” antenna is very simple and produces decent gain without being directional (i.e., the signal strength is pretty much the same in all directions). We have maintained a line-of-sight range of over 30,000’ with this antenna along with the
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external antenna on the Eggfinder LCD receiver, we think that most people will find that this simple antenna will suit their needs just fine if your primary goal is to get good enough GPS data to help you easily find your rocket. It's relatively small, very lightweight, and easy to build.

In some cases, however, you may need to use a different antenna, or a remote antenna (for example, if you have a carbon fiber rocket; you can't mount an antenna inside a CF rocket because they block RF signals). If you want to track your rocket's flight as accurately as possible or if you are intending to fly over 30,000', you may need to use a higher gain antenna, such as a 3 dB dipole antenna. In that case, you will want to go with the RP-SMA connector option. Note that any antenna that you get must have an RP-SMA MALE connector on it; this connector has INSIDE threads with a JACK in the center of the connector. It must also be rated for the 900 MHZ band, NOT 2.4 GHz. Be careful what you buy, we have seen some eBay-type vendors that are selling 2.4 GHz "WiFi" antennas for use with 900 MHz systems. They "will" work, but they are certainly not optimal, and would most likely produce less range than the stick antenna. Also, be sure that it's a RP-SMA antenna; we've seen some vendors selling standard SMA antennas but calling them RP-SMA. Finally, we recommend that you don't buy an antenna unless the vendor has the data sheets for it, showing the SWR and the beam pattern. An optimal SWR for a 900 MHz band antenna would have a center frequency of about 915 MHz, with a SWR in the low 1's at that frequency. If the graph doesn't look like that, it's probably a wideband or multiband antenna and you need to look elsewhere.

Note: You MUST use an "omnidirectional" antenna on the Eggfinder TX board. The gain on the antenna must be 6 dB or less. Do NOT use a "directional" antenna; they only work in one direction, so if your rocket isn't pointing in your direction you're not going to be able to pick up a signal.

Directions for installing a RP-SMA connector are at the end of this manual; the following instructions are for the "stick" antenna, and can be skipped if you are going to use a connector.

<u>Building the "Stick" Antenna</u>

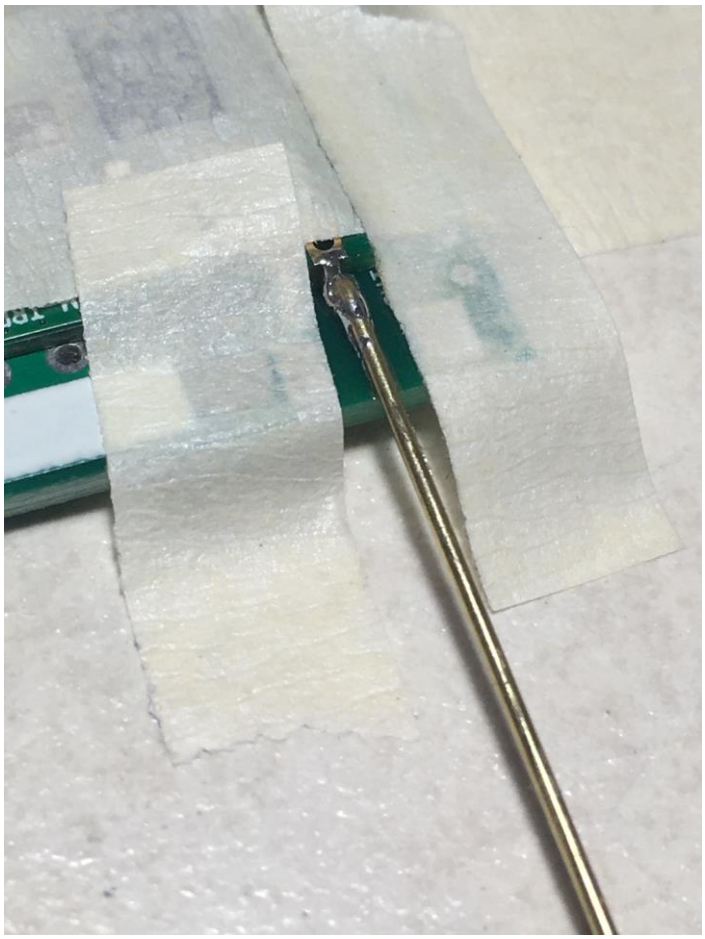
___ Using a hard eraser or emery cloth, clean about ½" from one end of the antenna to remove any signs of oxidation.

___ Bend one end of the 1/32" brass antenna wire in a 90° angle, about 1/8" from the cleaned end. Trim it to about 1/16".

___ Put the bent end of the antenna into the hole on the top of the board marked ANT, but **do not** solder it in. Tape it down so that it points straight out from the board

___ Cover the pads on either side of the ANT pad with some masking tape to keep solder off of them… a solder bridge between the ANT pads and the ground pads next to them will prevent the signal from getting out.

___ Insert the bent end of the wire into the ANT hole on the top of the board. Tape the end down so that it's straight out from the board and centered on the ANT pad. Solder it in place on the ANT pad on the TOP of the board, making sure that it sticks straight out from the board. The solder should also flow onto the pad on the RF module on the ANT pad, so that there's a nice fillet of solder on the "half-moon" pad.



___ Remove the tape from the RF module and the board.

___ Measure 80 mm from the edge of the board, and mark the antenna wire there.

___ With a pair of sharp diagonal pliers, cut the wire at the 80 mm mark.

___ With some emery cloth or a fine jeweler's file, file down any sharp edge at the cut so that it is flat. Feel the edge with your finger, if you feel a sharp edge then keep filing until it's smooth. The goal is to get rid of any sharp edges, as these rob RF power and cause unwanted harmonics in your output signal.

___ Slide the heat-shrink tubing over the antenna wire, then with a heat gun or small torch on VERY low heat, carefully shrink it over the wire. Clip the excess heat shrink tubing.

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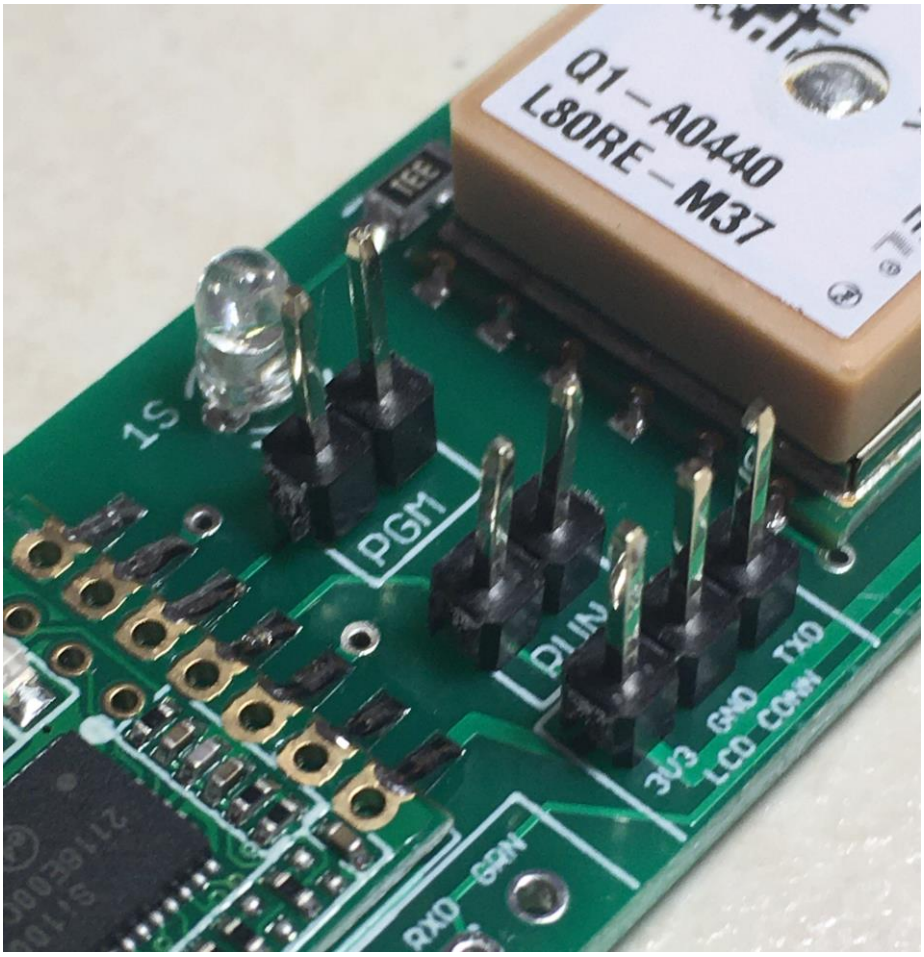
___ Mount the 2-pin PGM Header

With a pair of needle-nose pliers, break two pins off from the remaining 3-pin header.

Locate the spot for the 2-pin header marked “PGM”. Place the 2-pin header into the pads, short side through the board, then tape it into place so it can’t move. Turn the board over and solder the two pads.



___ Place the jumper on the RUN pads

If you removed the jumper across the RUN pads when you were soldering the RF module, replace it.
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Assembly of your Eggfinder TX 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.

Powering your Eggfinder TX

The Eggfinder TX requires 4.5V-15V, with a nominal working current of about 70 mA. However, when first powering up it may have peaks of up to 200 mA as the GPS module acquires satellites. For this reason, we recommend that you use a 7.4V 2S LiPo battery pack; just about any one you buy will have enough capacity for run your Eggfinder TX board for at least two or three hours. DO NOT use a 9V battery, they do not supply enough current. 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 TX 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. If you have a 38mm minimum-diameter rocket, a 200 mAH 2S LiPo works fine, and it's quite small.

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 (actually a JST-RCY), so it is very common to use a JST female "pigtail" on the board.

Since the Eggfinder TX 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. You can add one, of course, but 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 remove the power. See the Eggfinder User's Guide for tips on using it in flight.
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Testing Your Eggfinder TX With An Eggfinder Receiver

To test your Eggfinder TX, first connect the battery. The red light on the RF module should immediately start blinking. (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… after you read the User's Guide for it.

If you do, turn it on, set it to 915 MHz/ID=0, and see if you get a fix. If the orange LED on the Eggfinder TX 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 TX 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 TX 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. 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 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 splatter will almost always cause more damage than the original solder bridge, and if you get solder splatter on the RF module or inside the GPS 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 TX 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 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. Components that are polarized are:

• The LEDs, the long leads should have been inserted in the pad marked "+". Unfortunately, once you clip the leads it may be difficult to tell if you have inserted it correctly. For example, if the amber LED is backwards, the little red LED on the RF module will blink, but the amber LED will never come on.

• The bridge rectifier. If you put it in backwards, nothing will work. At all. Fortunately, it's well marked, so you shouldn't have a problem figuring out which way it's supposed to go.

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. We recommend a 2S/7.4V LiPo battery… see the discussion on powering your Eggfinder TX earlier in this manual.

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 capacitors
- Missing/loose shorting jumper on the RUN header
- Bad solder joint on battery connector pads
- Bad solder joint on voltage regulator
- Bad solder joint on the bridge
- Bad solder joint on 10 uF capacitors
- Solder bridge "somewhere" on the board… time to go hunting with a lighted magnifier

AMBER LED doesn't flash, and 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
- Amber LED is backwards
- Bad solder joint and/or bridge on Amber LED
- Bad solder joint and/or bridge on 330 ohm resistor

Installing a RP-SMA Connector for an External Antenna

If you decide to install a RP-SMA connector for an external antenna on your Eggfinder TX board rather than using the "stick" antenna, you will need to follow the directions below.

For each board on which you want to install a connector, you will need:

___ RP-SMA board-edge connector, straight, .062" (1.5mm) board thickness
(Linx Wireless part number CONREVSMA003.062 or equivalent)

You can get these from Eggtimer Rocketry, and you can also get them from electronics distributiors such as DigiKey, Mouser, and Future Electronics. They're under $5 each in small quantities.

If you look at the connector, you will see that there are two sides, separated by the thickness of the PC board. The TOP side has three pins, the BOTTOM side only has two (there is no center pin). Inside the outside-threaded connector is a pin; this is why it's called a "reverse" connector, normally outside-threaded connectors have a socket in them and the matching connector (with inside-threads) has a pin.

___ Slide the RP-SMA connector on the edge of the board, so the three pins on the top line up with the pads on the top of the PC board. With some masking tape, tape it into place on the bottom side of the board so it won't move, leaving the pins and pads on the top side untouched.

___ Solder ONE of the side pins on the top side to the pad on the top of the board. (Note: You may find that the solder that comes with the Eggfinder kit is too fine for soldering these large pins to the board; if that is the case, use some "conventional" .032" 60/40 rosin-core solder for the outer pins, but you DO need to use the included solder for the center antenna pin.) Let it cool for at least 30 seconds.

___ Check the connector to make sure that it is straight. If it has gotten a little crooked, heat up the solder joint and gently move the connector into place.

___ Solder the other two pins to the pads on the top of the board.

___ Turn the board over, remove the masking tape, and solder the remaining two pins to the pads on the bottom of the board.

We recommend that use use a quarter-wave antenna for the TX, we've had excellent results with the Linx Technologies ANT-916-CW-QW. You can get it for about $10 from electronic distributors such as Mouser or DigiKey.

Mounting an Openlog Datalogger

There is a spot next to the RF module for a standard Openlog datalogger. This gives you the capability to record all of the GPS data to a micro SD card, so you can use a program such as Google Maps to create a 3D map of your flight using the saved NMEA data. Openlog dataloggers can be purchased for under $20 from eBay and a number of other sources. Be sure to get one with the 6-pin header… most of them come with it, but we've seen a few that do not. You'll need to get a micro SD card, too… size doesn't matter, an 8 GB card will save weeks of continuous data.

To mount the Openlog:

__ Solder the 6-pin header on the TX board so that the short side of the header is soldered to the TX board; the longer pins should be facing up.

__ Place the Openlog module so that the micro SD card holder is facing UP (the slot should be facing away from the header). Leave a little space between the top of the RF module and the bottom of the Openlog module (which has parts on the bottom of its board); about 1/32" should be fine. A penny works fine as a spacer. If you have to, use a little tape to hold it in place.

__ Solder the header to the top side of the Openlog, making sure that the module doesn't slide down and touch the components on the RF module. After you've soldered all the pins, trim them down. If you've used a penny to space the Openlog module, remove it.

__ Put a micro SD card into the Openlog, then power up your TX. You should see the blue LED on the Openlog blinking when the red LED on the RF module blinks, that means that it's recording.

See the "Using An Openlog Datalogger with Eggfinder Transmitters" manual on the Eggtimer Rocketry web site for further information on setting up your Openlog and using the saved data.

Programming the Frequency on your Eggfinder TX

Eggfinder TX's are shipped with a default frequency of 915 MHz (unless you specified otherwise when you ordered it, or it's an AUS/NZ version). You may want to change the frequency of your Eggfinder TX if you find that other flyers are using the same frequency, this is easy to do if you have the 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.

To change the frequency:

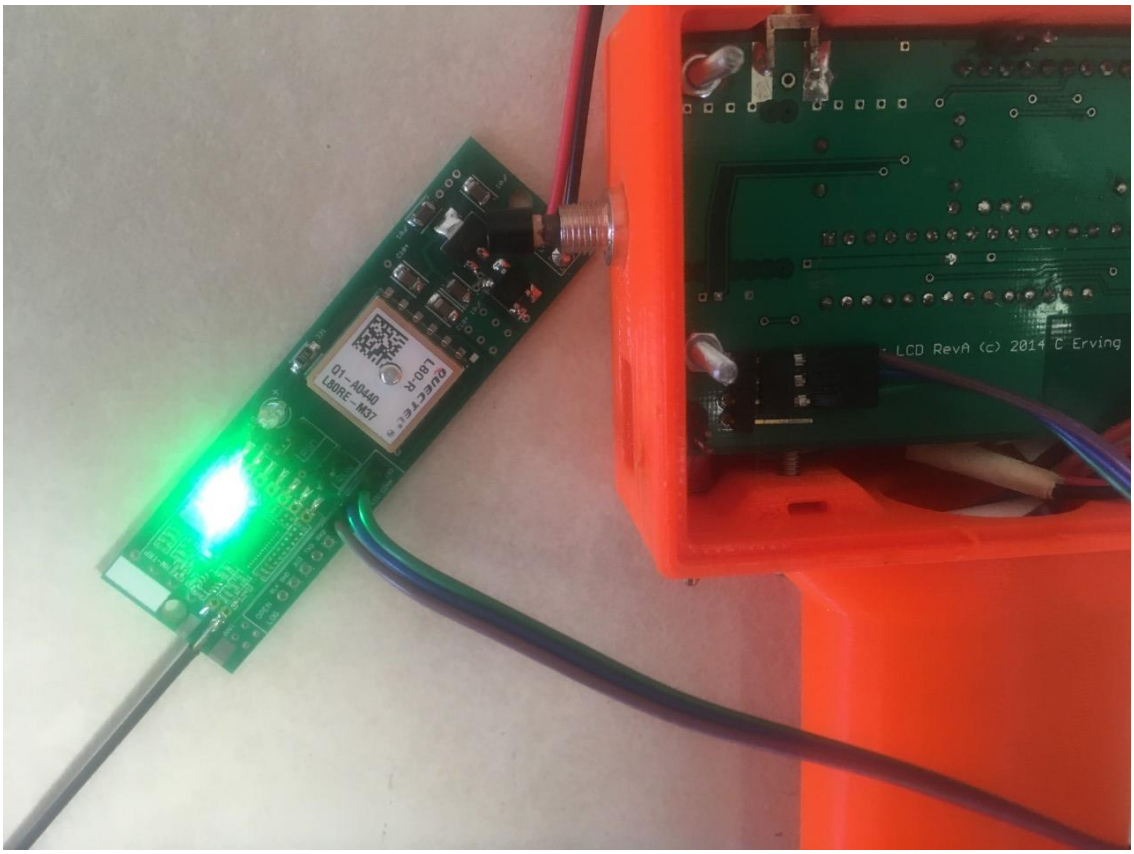
• Do NOT connect a battery to the Eggfinder TX… it will get its power from the LCD receiver.

• Open up the case on your LCD receiver, and turn OFF the power.

• Move the shorting jumper from the RUN position to the PGM position.

• Connect the 3-pin programming cable to the TX & 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. Plug the other end of the cable into the TX's LCD header, MAKING SURE THAT THE 3 WIRES ARE CONNECTED TO THE SAME PINS ON BOTH THE TX AND THE LCD. DOUBLE-CHECK BEFORE CONTINUING!



• Turn on the LCD receiver's power… the TX 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.

• 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 TX 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 TX, and move the shorting jumper on the Eggfinder TX from PGM to RUN.

• Power on the TX, the RED LED on the RF module should start blinking

• Power on the LCD receiver, the GREEN LED on the RF module should start blinking in sync with the RED LED on the TX. 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.

Shockproofing Your Eggfinder TX

The Eggfinder TX 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.