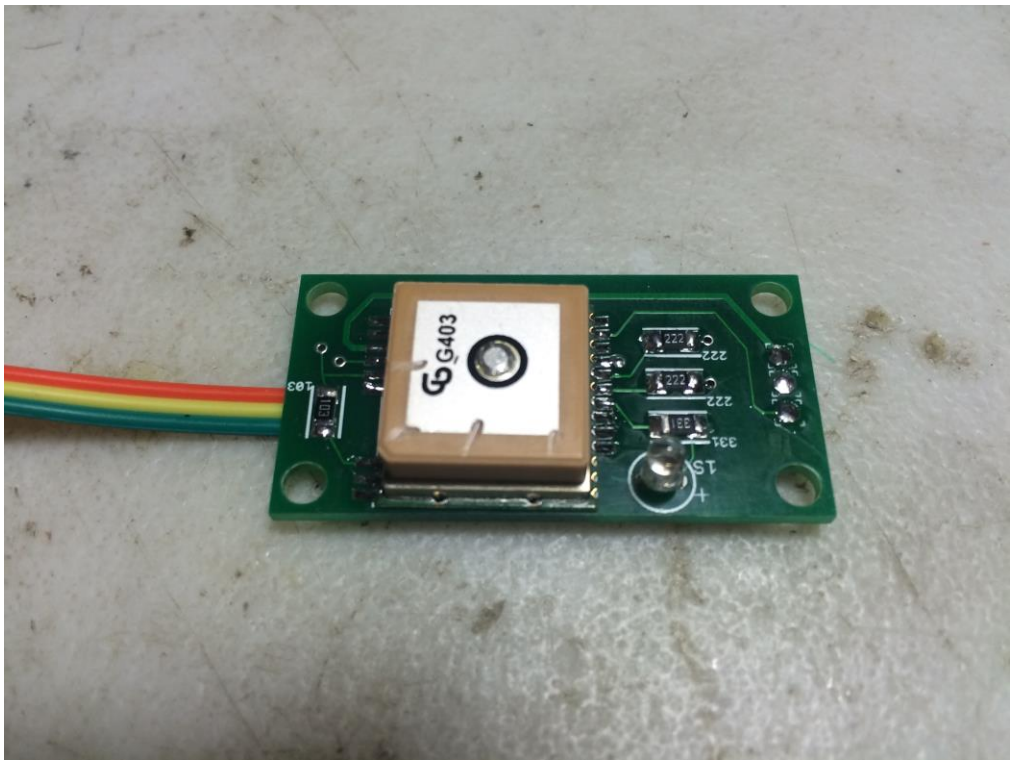
Eggfinder LCD-GPS Board
Assembly/User's Manual

Board Rev B2



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)
http://www.ecfr.gov/cgi-bin/text-idx?SID=adb12f74b498e43ec453f7899d9df0fd&node=47:1.0.1.1.16&rgn=div5

Hope RF HM-TRP Documentation (FCC test documentation)
http://www.hoperf.com/upload/rf/HM-TRP-915(20dBm)-FCC.pdf

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

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Before You Start…

• Go to our web site at www.Eggtimerrocketry.com 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 LCD-GPS Board! This accessory to the Eggfinder LCD Receiver, along with software versions 1.10N and up, gives you a fully autonomous rocket tracking solution. With nothing other than the LCD receiver, you will know exactly how far your rocket is from you, what direction, and when you start walking/driving towards your computer it will tell you your heading and which way you need to go to get to your rocket.

Unlike the base Eggfinder LCD receiver, you do not need any other devices to recover your rocket, because the navigation function that would normally be provided by a phone/tablet or a handheld GPS navigator (i.e. Garmin, Magellan) is built into the LCD receiver's software. No Internet or other services are needed.

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!).

Note: The User's Guide section of this manual supplements the Eggfinder LCD User's Guide, since some of the functions are substantially different with the addition of the LCD-GPS board. The programming and frequency changing functions are unchanged; however the tracking functions are greatly enhanced. Refer to the Eggfinder LCD User's Guide for introductory information, then come back to the LCD-GPS User's Guide to see what has changed.

About Soldering Your Eggfinder LCD-GPS Board…

Assembling your LCD-GPS board 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!

This board 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, there are two "modules", the GPS module and the RF module, that 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 GPS 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 LCD-GPS Board, we recommend a small pencil soldering iron, about 15W. If you are only going to use it occasionally, Weller makes a decent cheap 12W iron, it's about $15. There is also a similar iron that's sold by ECG. We like those, but the copper tips seem to oxidize and corrode rather quickly compared to some more expensive irons; fortunately, the tips are replaceable and cheap. Better would be a fancier soldering pencil with iron tips; those run about $30, but they'll last forever. The best iron would be a temperature-controlled solder station, they typically start at about $50 for a cheap one and can go to a few hundred dollars if you want to get really fancy. Weller makes a good one for about $50, if you make the investment that will probably be the last soldering iron you will ever need to buy. These solder stations usually have a little well with a tip-cleaning sponge, so they end up taking less room on your workstation too. Get the smallest tip you can find, preferably 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 small damp sponge for cleaning the tip of your soldering iron

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

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

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

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

___ A round wooden toothpick

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.

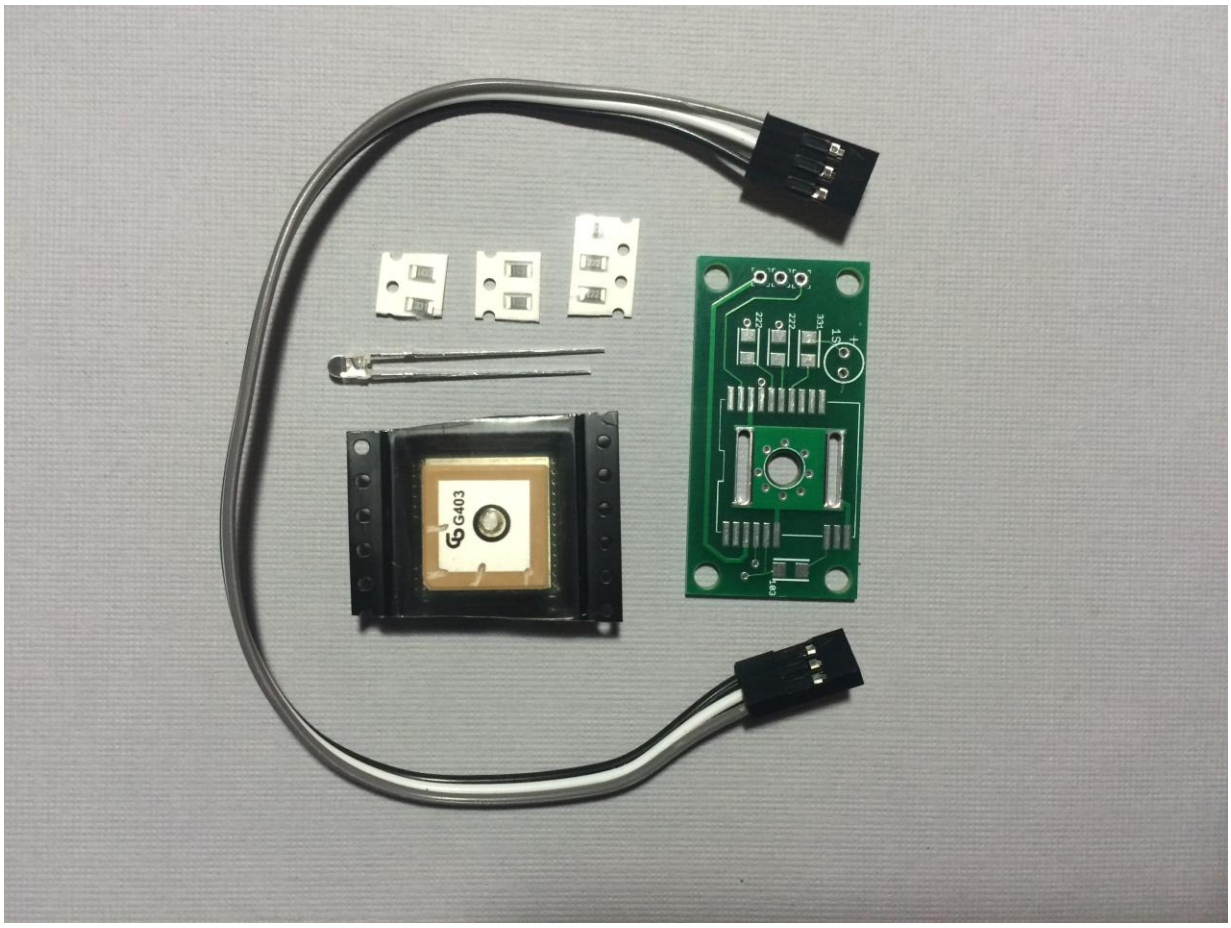
We strongly recommend that you consult the assembly pictures on the Eggtimer Rocketry web site, www.EggtimerRocketry.com. Go to the "Photos" link on the sidebar, and find the pictures that go along with your kit. Each step is pictured, so you can see exactly what you need to be soldering. Looking at the pictures as you go will help prevent you from soldering the wrong thing, or putting something in the wrong way.

Assembling your Eggfinder LCD-GPS 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
__	1	Maestro Wireless A2235H GPS module
__	1	3mm Amber LED (it may be clear)
__	1	330 ohm 0805-sized resistor (marked "331")
__	2	2.2K ohm 0805-sized resistor (marked "222")
__	1	10K ohm 0805-sized resistor (marked "103")
__	1	Coil of .020" 63/37 No-Clean solder wire
__	1	8" 3-conductor jumper, female-female
__	4	#4-40 x ¾" long Nylon machine screws
__	4	#4-40 Nylon nuts
__	4	#4 x ¼" Nylon spacers



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 resistor 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

LCD-GPS board 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 kit 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.

Check Your Eggfinder LCD Receiver's Firmware Version

The Eggfinder LCD-GPS Board requires at least version 1.10N of the Eggfinder LCD receiver firmware in order to be recognized. Before you do anything else, if you are on an older version of the firmware (i.e. 1.09e), update the firmware in your LCD receiver. Instructions are on the Eggtimer Rocketry web site, but we've also added them to the end of this manual for your convenience.

Assembling the LCD-GPS Board

Mounting the GPS Module

The very first thing you will be mounting is the Maestro Wireless A2235H GPS module. It's a square part about 5/8" square and ¼" deep, it is actually a small circuit board with an integral patch antenna. There are very tiny parts mounted on the board, fortunately you don't need to worry about any of that, you're just going to solder the GPS' pads onto the Eggfinder board.

It is CRITICALLY important that you get this part mounted properly, because once you solder it in it will be impossible to remove it. We're not talking "difficult", we're talking "impossible". Work slowly and carefully!!!

It is also very important that you do not overheat the GPS module. While it IS designed to be heated in a commercial SMT reflow oven, it CAN be damaged by overheating. You're not

likely to generate enough heat to damage the module, but you don't want to be taking chances. The solder joints on the top of the board are primarily electrical connections, the ones on the bottom of the board provide the main mechanical mounting. While every solder joint is important, the ones on the bottom are especially so, because they hold the GPS module in place and provide a good ground path for the GPS patch antenna.

__ Lay the Eggfinder PC board down in front of you with the "ANT" side to the left. With some PAPER masking tape, tape the left and right edges of the board to your work surface so it will not move.

__ Carefully remove the GPS module from its packing. You will notice that one row of pads goes all the way up the side, and the other row has a "break" in it. You will also notice that the GPS module's pads have a "half moon" in the center of the pads; this is to increase the solder mounting surface when hand-soldered. You will also notice that there are eight square pads on the bottom of the GPS module; this is to provide a better ground plane with the PC board when soldered (more on that later).

__ Tape the board down to your work surface, without covering the GPS pads.

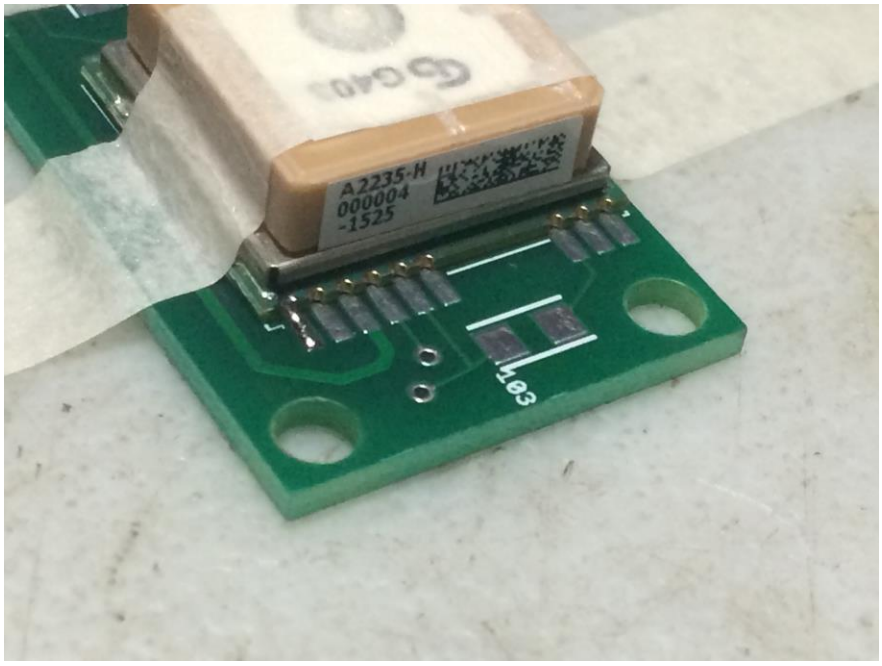
__ Cut two pieces of PAPER masking tape about 1/8" wide by 1" long. Cover the open gaps in the GPS' metal shield next to the pads. If you have to, use more than one strip, it's OK if a little bit of the tape overlaps the top of the solder pads (since we're going to be soldering the sides of the pads). This is an important step, because it prevents any solder from getting onto the GPS module's own PC board, which would almost certainly ruin it.

__ Cut a piece of PAPER masking tape about ½" wide by 2" long. CAREFULLY lay it across the top of the GPS module, between the sides that DO NOT have the pads.

__ CAREFULLY place the GPS module on the Eggfinder's GPS pads, making sure that the "long" row of pads lines up with the "long" row on the board, and that the "half-moons" on the GPS module's pads are centered on the Eggfinder's pads. With one hand, hold the module in place, and with the other hand smooth the masking tape down against the top of the module so that it securely holds the GPS module in place. Gently tap the GPS module, it should not move; if it does, repeat the procedure with a new piece of masking tape.

__ DOUBLE-CHECK that the GPS module is properly oriented, and that the pads are centered on the PC board's pads. A jeweler's loupe or small 10x magnifier is very handy for this purpose.

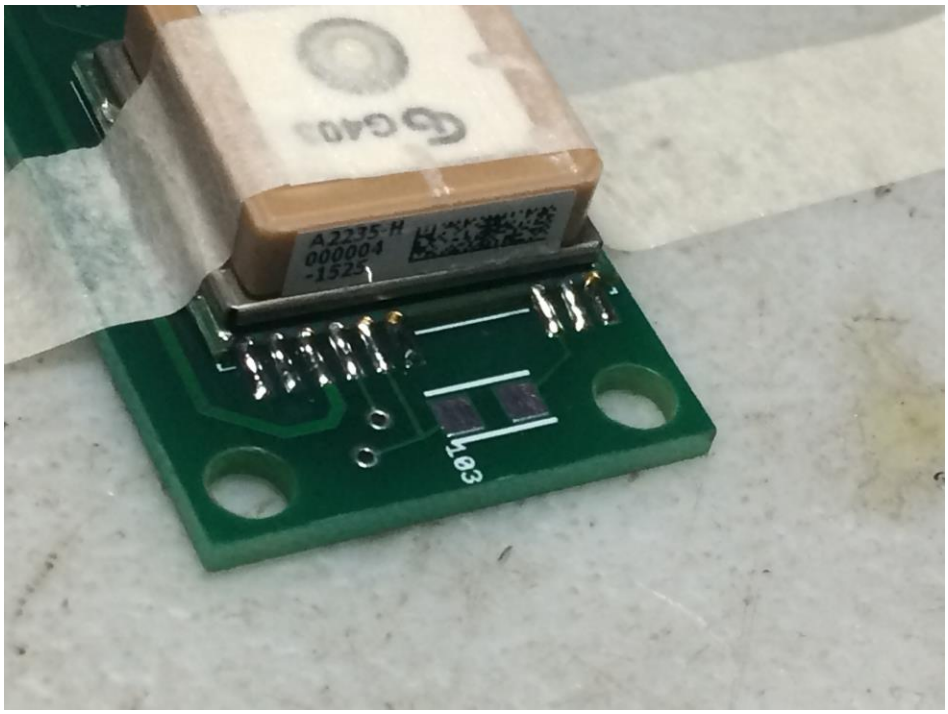
__ Using as little solder as possible, solder ONLY the pad at the lower-left corner of the GPS module. Use only enough solder to get the GPS pad mounted to the board, it won't take very much. You should hold the iron for about 5 seconds after the solder flows, then remove the heat and wait at least 30 seconds before you touch anything. If you do this right, you should see a nice shiny solder joint filling in the gap between the PC board and the GPS module's pad, with a slight radius as it transitions from the board up to the GPS module's pad. The solder should just fill in the half-moon on the side of the GPS module's pad.



__ CHECK AGAIN that the GPS module is properly oriented and that the pads are centered on the PC board's pads. If the GPS module moved a little during soldering, heat up the solder joint and GENTLY move it into place. If you cannot get it to move without removing it, remove the masking tape, heat up the solder joint, then GENTLY lift the module from the board. Remove the solder with some wick, get a new piece of masking tape, and try again.

__ Once you have successfully soldered the lower-right corner pad and confirmed that the module is properly oriented on the board, repeat the procedure for the other three corners in this order: Lower-Left Corner, Upper-Left Corner, Upper-Right Corner. Be sure to wait at least 30 seconds between each solder joint.

__ Using as little solder as possible, solder the remaining pads on the GPS module, skipping pads and alternating sides so that you do not solder adjacent pads consecutively. This helps prevent the GPS module from getting too hot. Be sure to allow each solder joint to cool for at least 30 seconds before you move on to the next one. Make sure that the solder joints fill the "half moon" cutouts in the GPS module pads.



__ Remove the masking tape from the GPS module, and remove the masking tape holding the board to your work surface. Turn the module over, and with two new pieces of masking tape tack it down to your work surface so it will not move (yes, it will be upside-down).

You will now be soldering the eight square pads on the bottom of the GPS module to the PC board. They are visible through a "channel" on each side. What you are going to be doing is filling the channels with solder, so that you get a good bond between all eight pads and the board. Please read this procedure carefully BEFORE you start soldering, it is important that you do not overheat the pads on the GPS module.

__ Hold your soldering iron upright and gently slide it into the left side of the channel, then put some solder into the channel next to the tip. Fill up the space, then gently slide the tip down the channel while you add solder. If the solder cools immediately when you move the tip, you need to either turn up the heat on your iron a little bit, or use a slightly larger tip; you want to keep enough heat on the solder so that it stays melted in the channel while the tip is there.

As you move the tip, the level of solder in the channel will drop a little bit. That's OK, but you need to add solder to keep the level up while you're moving the tip. The goal is to melt the solder down the channel onto the GPS module's pad underneath. The solder should flow down the channel and onto the pad underneath. Once the channel is filled with solder, remove the heat. If the coverage appears to be incomplete, add a LITTLE more solder and reheat the pads for about 10 seconds, then let it cool down for 45 seconds before inspecting again.

__ Repeat the procedure for the other channel, after waiting at least a minute to let the GPS module cool down.

__ Remove the masking tape from the board, turn it over so that the GPS module is now on top, and tape the board down to your work surface again.

__ Inspect all GPS module solder joints to make sure that they are nice and shiny, and that they properly bridge the GPS module pads and the PC board pads. Leave the board taped down to your work surface for now.

__ Take a break and get a beverage… you just completed the hardest part of building the kit!

Mounting the Resistors

The resistors 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 resistor with tweezers in one hand and your soldering iron in the other, center the resistor on the pads.

3) Once you have it where you want it, touch the tip of the soldering iron to the top of the resistor 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 resistor in place.

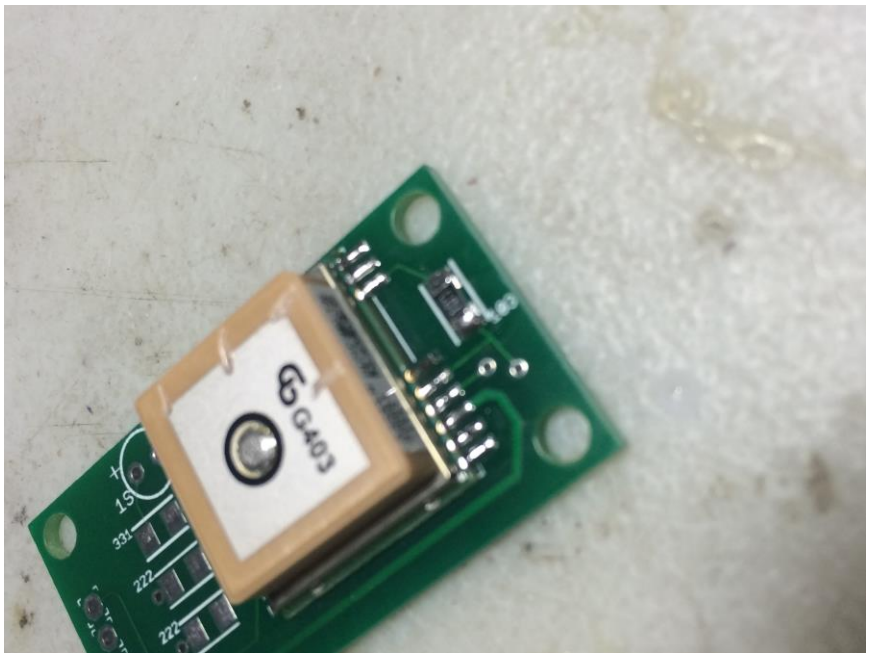
5) Wait about 5 seconds then let go of the resistor.

6) Now, solder the untinned pad to the resistor using only a tiny bit of solder, just enough to cover the pad and have it "wick" up the side of the resistor. This will take a very short time, so be ready to remove the soldering iron almost immediately. If you leave the iron on the resistor 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 resistor, 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 resistor. If you do reheat the resistor, be careful not to overheat it; if you do, both solder joints may melt and you may end up lifting the resistor off the board.

___ Mount the 10K resistor (marked "103" or "1022")

Locate the 10K resistor on the board, just to the right of the GPS module. Solder in place.



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

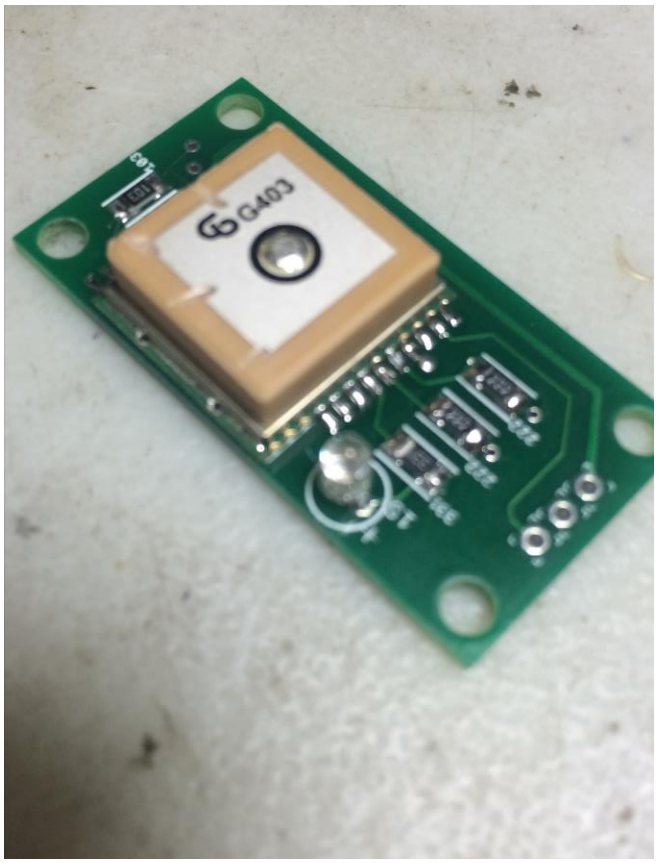
Locate the 330 ohm resistor on the board, just to the left of the GPS module. Solder in place.

___ Mount the 2.2K Resistors (marked "222" or "2211")

Locate the two 2.2K resistors on the board, just to the left of the GPS module. Solder them in place.

___ Mount the AMBER (1S) LED

If you're going to mount the LED so that you can see it from the front of the case, mount it on the side with the GPS module. If you're going to have it face inside the case, turn the board over so that the GPS module is facing down. 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.



___ Solder the Cable to the board

Clip the connectors on one end of the cable off. With wire strippers, carefully strip about 1/8" off each wire, then lightly tin the wires. Don't use too much heat, it will melt the insulation and cause it to "peel back".

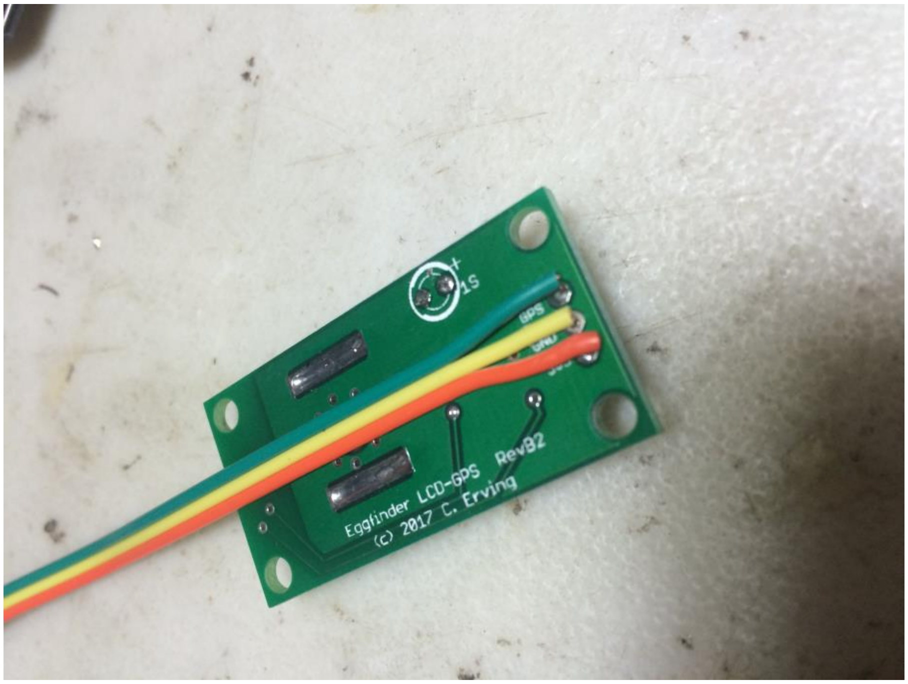
Insert the three wires into the three holes marked "3V3", "GND", and "TXD" from the BOTTOM of the board (the side that you mounted the LED, not the side with the GPS module and the other components). Tape the cable down temporarily to the board, turn it over, then solder the three wires to the TOP of the board. Trim the excess leads. Leave the cable taped to the bottom of the board for now.

Now, write down the colors of the wires that went to each pad… this is to help you later on when you need to hook them up to your LCD receiver's board.

3V3 _____

GND _____

TXD _____



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Marking Your Eggfinder LCD Receiver's Case

The first thing you need to do is to mark your case where the LCD-GPS Board is going to be mounted. This assumes that you are using the original case that came with the Eggfinder LCD receiver… if you're using a different case, you will have to modify this procedure to fit whatever case you're using.

___ Download and print the Eggfinder LCD-GPS template from the Eggtimer Rocketry web site (www.EggtimerRocketry.com , under Eggfinder Support\Documentation), and cut it out.

___ Open up the case of your Eggfinder LCD receiver. Lay the TOP down flat on the table, so the Eggfinder LCD board faces up.

___ Take the LCD-GPS' template and lay it down with the long edge horizontally, about one inch below the bottom of the Eggfinder LCD's circuit board. With some clear Scotch tape, tape the template down to the top cover. With an awl or other similar tool, mark the five holes. Note that one hole is a little bit larger, that's the one for the LED.
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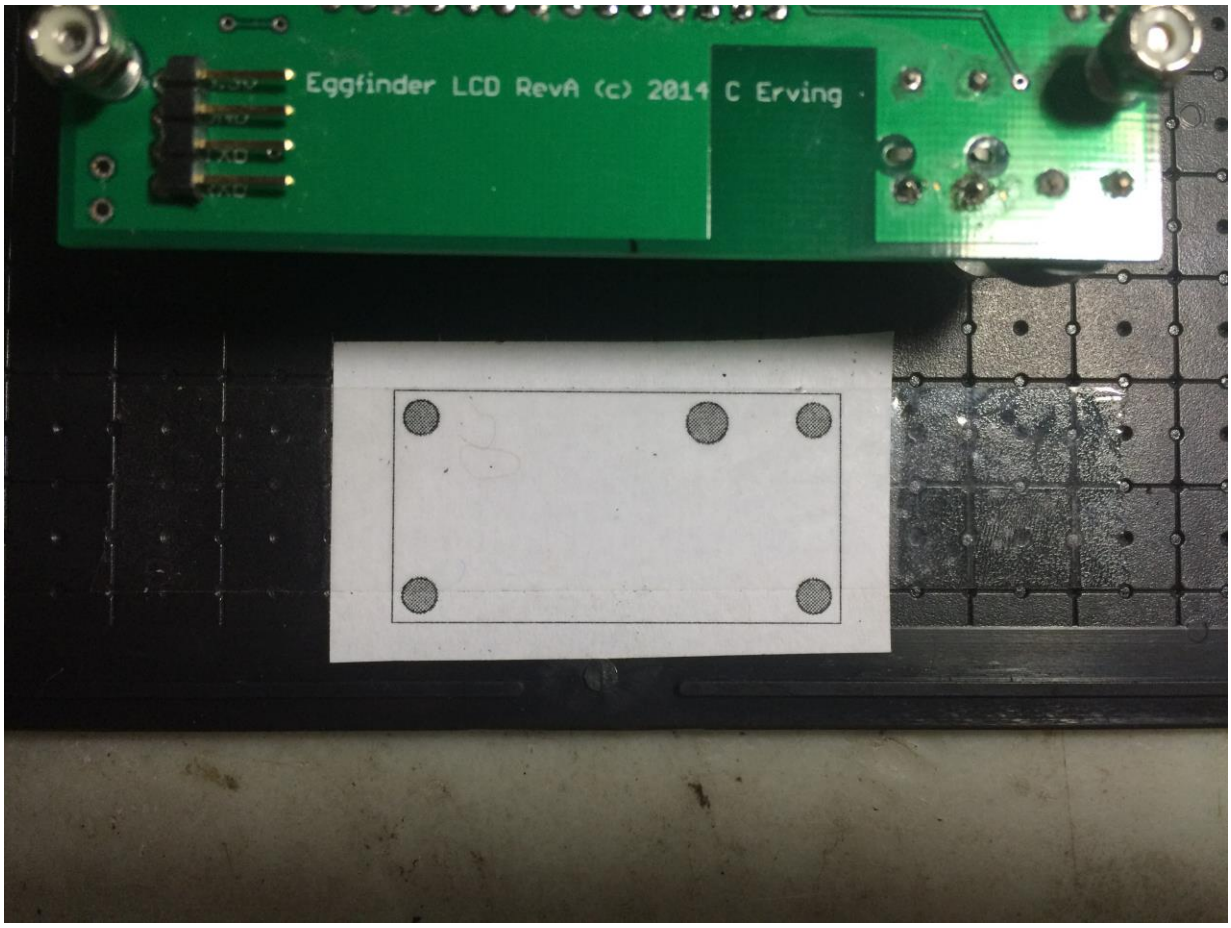
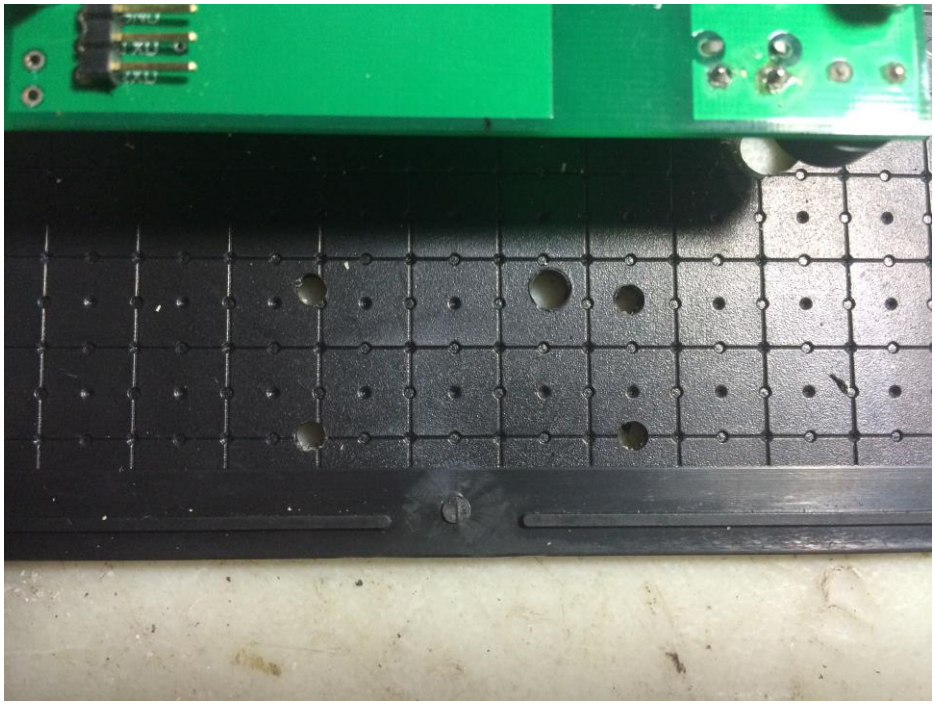


___ Double-check to make sure that the marks that you made match up with the holes in the PC board. Remove the LCD-GPS PC template from the cover, then with a 1/8” drill bit drill the four holes in the corners. Use a 5/32” bit to drill the hole for the LED.

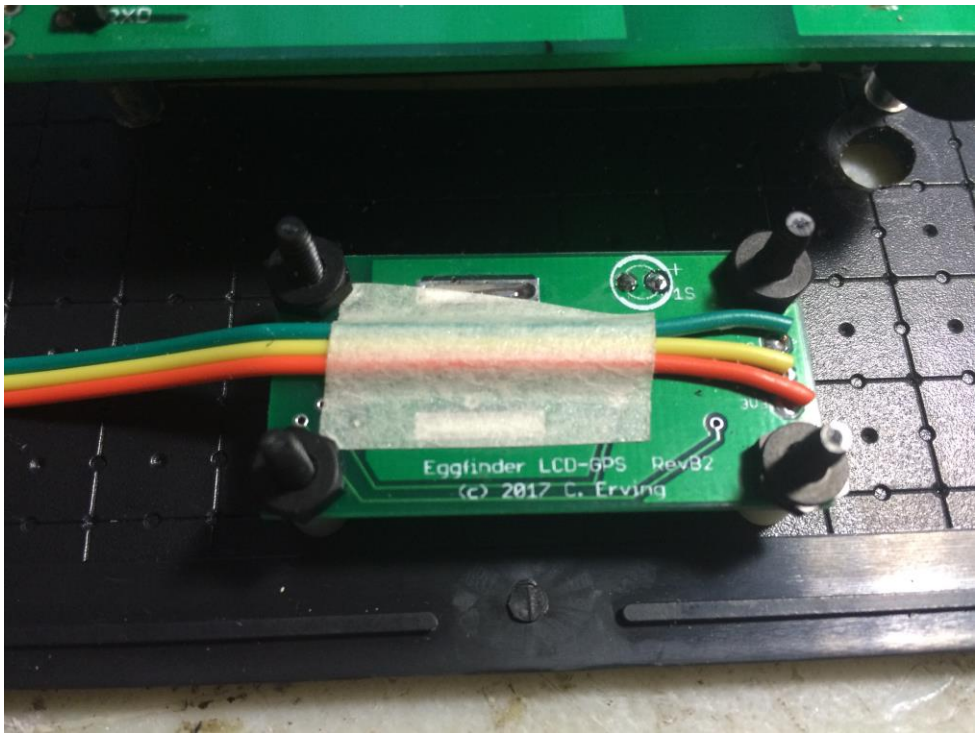


Mounting the LCD-GPS Board

___ Push the four Nylon screws through the LCD receiver's case top, with the screw heads on the outside. With some paper masking tape, hold them down so they won't fall out.

__ Turn the case top over and set it down on the table. Slide the four spacers over the screws.

___ Slide the LCD-GPS board over the four screws and the spacers, with the GPS module facing down (towards the case top) and the cable facing to the left.. Hand tighten the four Nylon nuts over the PC board. Remove the tape that you had temporarily put over the screw heads, and tighten the screws just enough so they are firm. Do not overtighten… you will strip them out if you do, and it's not necessary.



___ Carefully remove the tape from the LCD-GPS board. Lift the cable up a little, and with a hot melt glue gun put a blob of glue just to the left of the cable pads. Lay the cable down onto the glue, and let it cool for a few minutes. The idea is to allow you to move the cable without disturbing the relatively fragile wires soldered to the pads.

At this point, finishing the mounting will depend on whether you have a RevA LCD receiver board (the one shipped from 2014 through late 2017) or a RevB LCD receiver board (shipped starting in late 2017). You can tell from the writing on the bottom of the LCD recieiver PC board… if it says "Eggfinder LCD RevA2" for example, you have a RevA board. The RevB boards have a 3-pin connector especially for the LCD-GPS board, the RevA boards do not, so you will have to solder the wires to the board if you have a RevA board.

Connecting the LCD-GPS Board to an Eggfinder LCD RevA Board

___ Clip the other 3-pin connector off the cable. You're not going to need it… you're going to be soldering the wires directly to the board.

___ Carefully separate the three wires, up to about 1" from the hot melt glue joint that you did earlier.

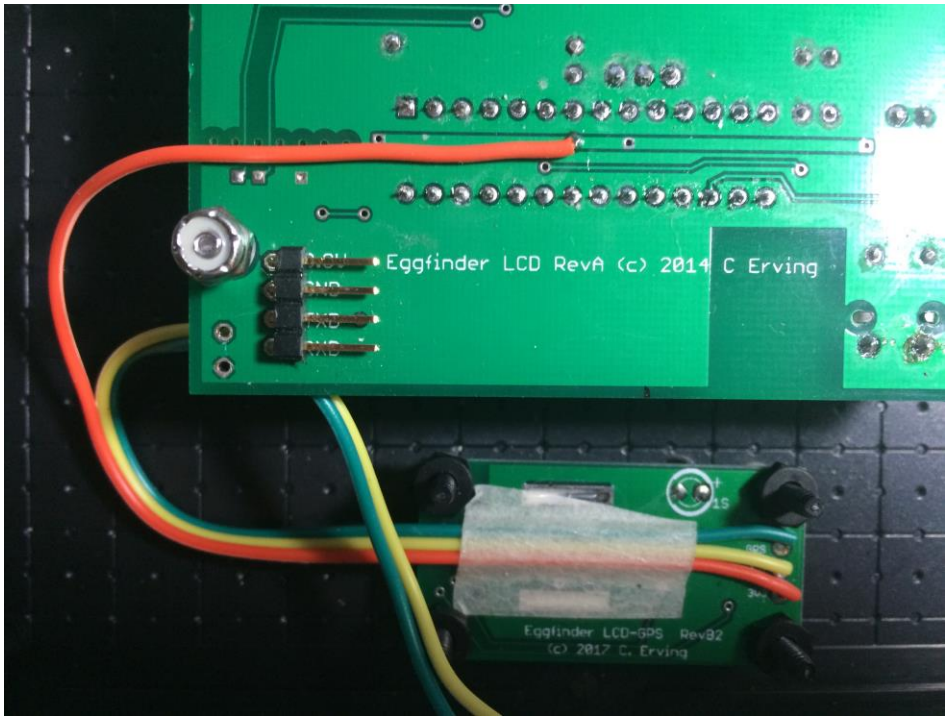
___ Write down the color of the 3V3 wire that you soldered to the GPS-LCD board earlier…

3V3 _____

If you look carefully at the LCD receiver's board, you'll see that between the pads on the processor is a long and relatively fat trace, with four holes ("vias") in them, this trace goes the entire length of the processor. This is the 3.3V bus. You'll also notice that one of the holes is a bit larger than the others. We're going to solder that 3V3 wire into that hole. (Refer to the picture below)

Take the 3V3 wire (check the color again!) and loop it around the left side of the board (the side with the 4-pin connector). The idea is that you don't want the cables from the LCD-GPS board interfering with the 4-pin connector, since you need it for software updating and installing a Bluetooth module. Trim the cable so that it's about ¼" longer than it needs to be to reach that hole. Strip about 1/8" from the end of the wire, then tin it. Test fit it into the hole, it should poke up just a little bit, enough to get a solder fillet around it. Temporarily tape it down with some masking tape, then solder the wire into the hole.

The 3V3 wire in this picture is ORANGE.



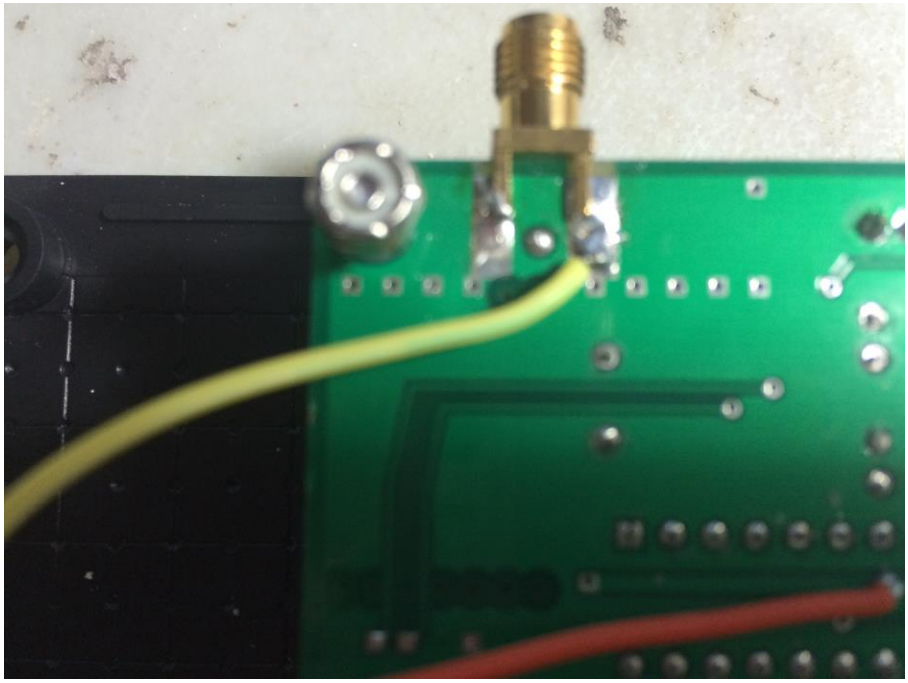
___ Write down the color of the GND wire that you soldered to the GPS-LCD board earlier…

GND _____

You will be soldering this wire to the leftmost antenna ground pad, it's about 1/8" x ½" at the top of the Eggfinder LCD receiver's board.

Take the GND wire (check the color again!) and loop it around the left side of the Eggfinder LCD receiver board, then trim it so that it's about ¼" longer than it needs to be to reach the leftmost antenna mount. Strip about 1/8" from the end of the wire, then tin it. If you are using the wire antenna, simply solder the wire to the antenna mount pad since there's nothing there. If you have installed a RP-SMA connector, you'll have to use a little more heat to solder the wire, since there's a (relatively) large piece of metal absorbing the heat. Take your time and don't overheat the wire.

The GND wire in this picture is YELLOW.



___ Write down the color of the TXD wire that you soldered to the GPS-LCD board earlier… it should be the only one left.

TXD _____

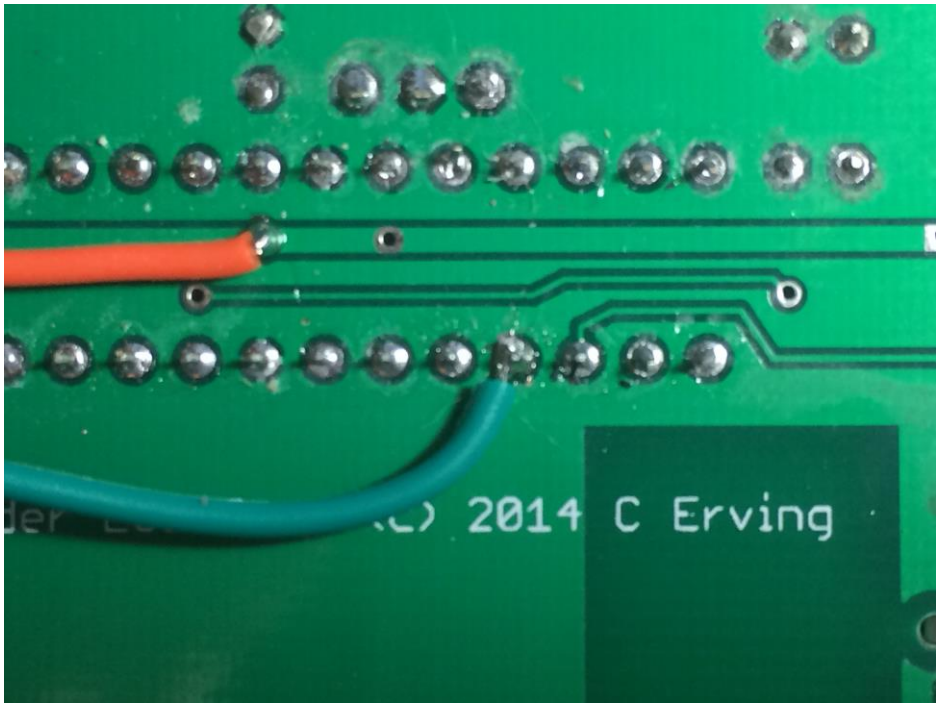
This is the tricky one. You're going to tack-solder the wire to one of the processor pins sticking out from the PC board. It's really not very difficult, if you do it right…

Take the TXD wire (check the color again!) and loop it around the left side of the board (the side with the 4-pin connector). You are going to be connecting this wire to the FOURTH LEAD FROM THE RIGHT ON THE BOTTOM ROW OF THE PROCESSOR.

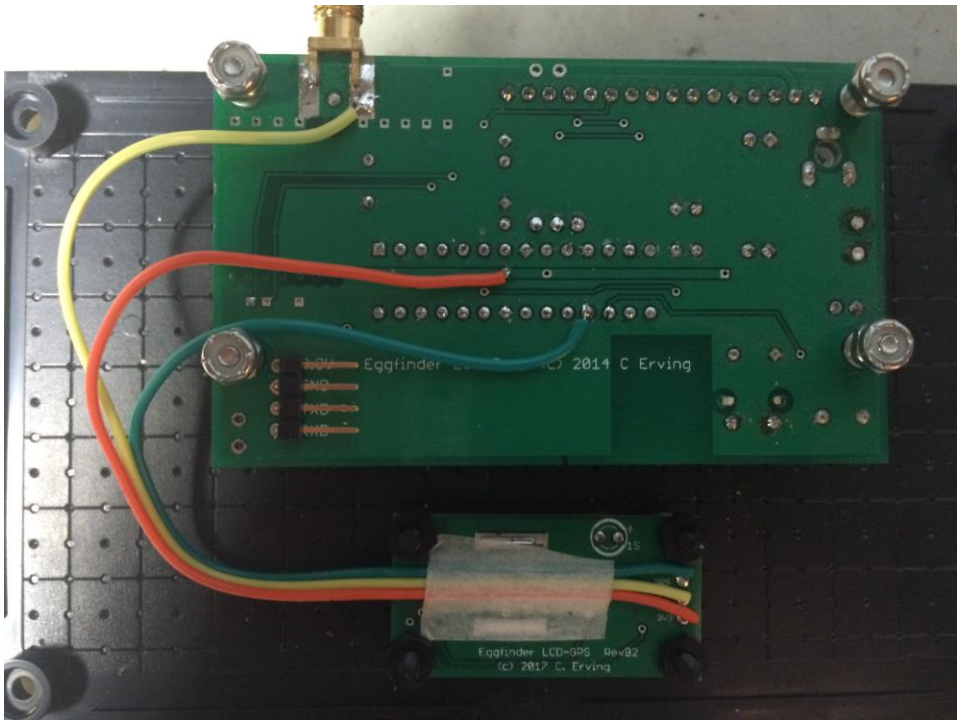
Trim the cable so that it's about ¼" longer than it needs to be to reach that hole. Strip about 1/16" from the end of the wire, then tin it. Cut a small piece of masking tape. Hold the tinned end of the wire against the FOURTH LEAD FROM THE RIGHT ON THE BOTTOM ROW OF THE PROCESSOR, and hold the wire down with the masking tape close to the pad. When you lift your finger off the tape, the tinned wire should remain against the lead… if it does not, do it again until it does.

Carefully solder the wire to the processor lead. Do not use more heat than you need to.. once the solder flows, remove the iron and the solder. You should see a nice fillet between the tinned wire and the lead.

The GPS wire in this picture is GREEN.



With some paper masking tape, tape the leads down so they can't move. You're done!



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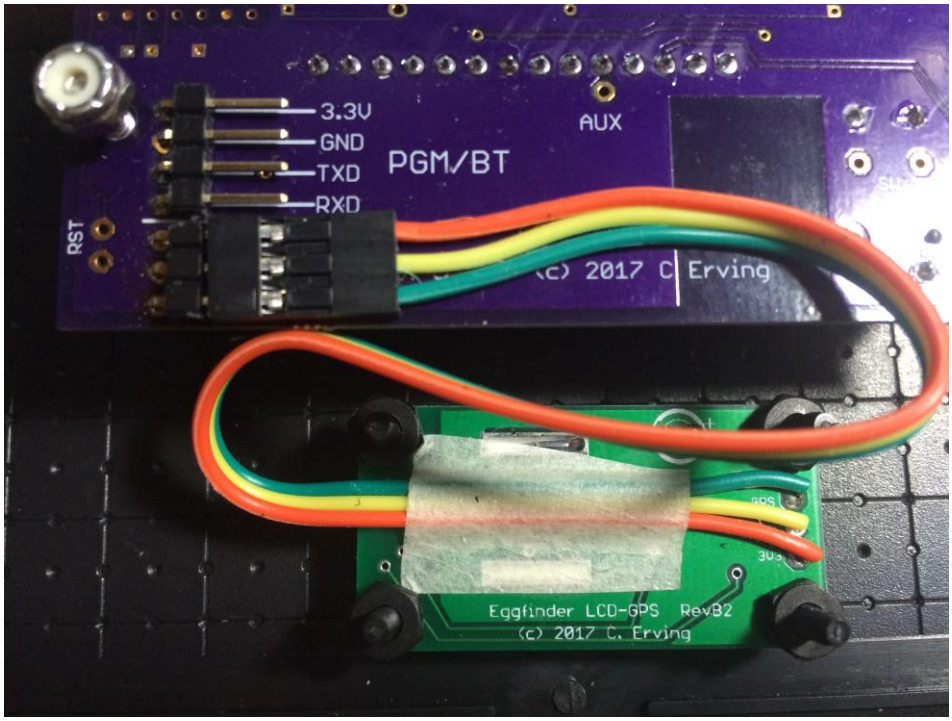
Connecting the LCD-GPS Board to an Eggfinder LCD RevB Board

___ Write down the color of the 3V3 wire that you soldered to the GPS-LCD board earlier…

3V3 _____

Plug the 3-pin connector into the 3-pin header on the Eggfinder LCD board marked “GPS”, making sure that the 3V3 wire is in the position marked “3V3”. You’re done!

The 3V3 wire in this picture is ORANGE.
The GND wire in this picture is YELLOW.
The GPS wire in this picture is GREEN.
~~~~~~



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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.
~~~~~~

Testing Your LCD-GPS Board

Replace the top cover of your Eggfinder LCD receiver, but don't screw it down yet.
Turn on your Eggfinder LCD receiver, place it face-up on your table, and allow it to cycle through the intro screen, the settings screen, and the "Waiting for Sync" screens. At this point, you should see a new screen:

```
Waiting for
GPS Module…
```

This means that the GPS module was detected, the the software is waiting to get a GPS fix. If you do this indoors it may sit here for as long as 30 minutes, since GPS doesn't work all that well indoors. If you do it outdoors, you'll generally get a fix within a minute or two.

When the LCD-GPS module has received a valid GPS fix, you'll hear a long beep, and see this screen, displayed for about 5 seconds:

```
GPS Fix…
```

…followed by the familiar screen:

```
Waiting for Fix
```

If you get here, everything is working properly… go to the User's Guide section below to find out how to track your rocket.

Troubleshooting

If your LCD-GPS board doesn't work after assembly and testing, turn off the LCD receiver, take a deep breath, get out a beverage to clear you mind, and start troubleshooting…

Check Your Firmware Version

The LCD-GPS board requires Eggfinder LCD firmware version 1.10N or higher to operate properly. Earlier versions (i.e. 1.09e) won't hurt anything, but the LCD-GPS board won't be recognized and you'll never get the "Waiting for GPS Module…" prompt. If you have an older version, update the software first.

Check Your Wiring

The very first thing you should do is to check to make sure that the three wires are connected to the right place. Check the colors, and take a look at the pictures of the wiring on the Eggtimer Rocketry web site. It's particularly easy to get the TXD wiring wrong… that's why we repeated it in ALL-CAPS…

See if You Get a Fix LED

Carefully peer under the case top with the power on. After a few minutes (less if outdoors) you should see the amber LED on the LCD-GPS board blink about once per second. This means that you have a fix. This is strictly a troubleshooting tool… it's not necessary for operation. Note that it may take as long as 30 minutes to get a fix indoors, so be patient. If you do NOT get an amber LED and you never get the "GPS Fix…" screen, then there's something wrong with the board.

Check Your Solder Joints

The next thing you should do is to check out all of the solder joints under a lighted magnifier. You are going to have to carefully unscrew the LCD-GPS board from the case top to do this… be careful, as the wires are relatively fragile at the solder joints. 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 GPS 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 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 LCD-GPS board 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.

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 major 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)

You Never Get the "Waiting for GPS" Prompt

- Bad wiring connection (check all three)
- Bad solder joint on GPS module "somewhere" (#1 reason for this!)
- Bad solder joint on 2nd pad from the bottom of the left side of the GPS module
- Bad solder joint on the 5th or 6th pads from the bottom of the left side of the GPS module
- Bad solder joint on the 5th or 7th pads from the bottom of the right side of the GPS module
- Bad solder joint on the 4th pads from the bottom on either side of the GPS module

…you get the gist of this… the GPS module pads are ALL important…

- Solder bridge on GPS module pads
- Bad solder joint on 10K or 2.2K resistors next to GPS module
- Solder bridge "somewhere" on the board… time to go hunting with a lighted magnifier

AMBER LED doesn't flash OR You Never Get "GPS Fix…"

- 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 GPS module
  (in particular, the 5th & 6th ones from the bottom on the left,
  and the 5th & 7th ones from the bottom on the right)
- Bad solder joint and/or bridge on the 10K resistor immediately to the right of the GPS
- Bad solder joint and/or bridge on the 2.2K resistors immediately to the left of the GPS
- Amber LED is backwards
- Bad solder joint and/or bridge on Amber LED
- Bad solder joint and/or bridge on 330 ohm resistor

Eggfinder LCD-GPS User's Guide

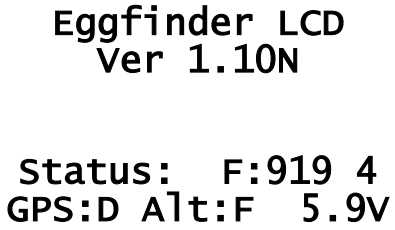
Note: This manual is a supplement to the Eggfinder LCD Receiver User's Guide. It only addresses differences from the "standard" Eggfinder LCD operation, it is not a comprehensive guide. It does not cover the programming, frequency updating, or pairing functions, or using it with other devices (such as the Eggtimer TRS). Since a large number of users will need to update their firmware in order to use the LCD-GPS board, we have included the instructions for updating the firmware for your convenience although they are not strictly part of the LCD-GPS' operation.

The primary difference between the "standard" Eggfinder LCD and the Eggfinder LCD-GPS is that the internal GPS allows you to track your rocket without the use of other devices. You do not need to enter the coordinates into a GPS-enabled device such as a phone, tablet, or handheld tracker like you do with the standard Eggfinder LCD (although the coordinates are provided so that you may still do so if you wish).

A lot of people like to use Bluetooth-enabled tracking applications that provide a real-time trace of the rocket's path, the problem with many of them is that they do not easily provide enough information for you to actually retrieve your rocket. With the Eggfinder LCD-GPS, that problem is solved… you can get your Bluetooth feed into your live-tracking app, and at the same time the display will show you exactly where your rocket is in an easy to read display.

Tracking Your Rocket with the Eggfinder LCD-GPS

The LCD-GPS module adds a few new screens to the standard Eggfinder LCD. When you first turn on the Eggfinder LCD-GPC you'll see the familiar screens



Followed by a new screen:

This screen tells you that the LCD-GPS board is present and the software is waiting for a valid GPS fix before continuing. Since proper tracking depends on getting a good fix from the internal GPS as well as from your rocket, the software will not continue until it receives a valid GPS fix. If you do this indoors (which you'll only do in testing, of course…) it may take as long as 30 minutes to pick up a GPS satellite fix. Outdoors, it usually takes just a few minutes, and more often than not under a minute.

Once you do get a fix, you'll hear a long beep, followed by this screen for about 5 seconds:

```
GPS Fix…
```

This tells you that there's a fix, and it's continuing… the next screen will be the familiar

```
Waiting for Fix
```

As usual, it will sit there until it receives a valid GPS fix from your transmitter. Once you get a fix from your transmitter, you'll see

```
33.12345 4▌ 0
-116.64738 1326
```

This is the familiar latitude and longitude screen, plus the Satellites in View (the "4"), the HDOP bargraph, and the altitude display (the "1326", which will be either the ASL altitude from the GPS module or the AGL altitude from the baro sensor if you're flying an Eggtimer TRS).

This information is very useful, but by itself it won't tell you where to go to look for your rocket. That's where the LCD-GPS board comes in.

Press the button on the LCD receiver (if you have not yet done so, we strongly recommend connecting an external button… see the Eggfinder LCD User's Guide for details). This will tell it to flip to the "Heading" screen…

```
C:347↑ 0  T:3 ↑
D:1770  ↑↑L:16
```

This screen tells you where your rocket is in relation to where you are right now, and which way you need to go to retrieve it. Before we go any further, however, we need to explain how this works.

Your LCD-GPS uses the concept of a "home" location. All of the calculations are made in reference to your current home location. The software in the Eggfinder LCD reads the internal GPS every 10 seconds to get the current (home) location. The GPS module actually puts it out every second, but you generally aren't going as fast on the ground as your rocket is moving in the air, and your rocket has priority so it's OK if the home location doesn't get updated as often.

The numbers on the top are referenced to "North-up", which means that everything assumes that you're pointed North. They are:

C: Compass Heading – The heading of the rocket in relation to you on the compass, North-Up, with you in the middle of the compass and the rocket on the outside. For example, the 347 means that it's 13 degrees to the left of North from your home location (360 – 13 degrees). If

you have a compass and point yourself at North and go 13 degrees to the Left, you'll walk right to your rocket. Of course, you'd have to have a good compass…

↑ Compass Arrow – An arrow that shows you, North-Up, the direction of your rocket from you. If it's going up like this one, it's "in front" of you; if it's pointing down (↓) then it's behind you; there are other directions too, but you get the idea.

0 Time to Last Fix – Just what it says… how many seconds since your last valid fix from the rocket. It will go up to 99, then you'll see "**"… just like on the latitude/longitude display.

T: Track. This is the direction that you are traveling, North-up.

The Track is very important, because that's what allows the LCD-GPS to be able to tell you which way you need to go. For that to happen, it has to know which direction you're going. The Eggfinder LCD-GPS takes your last two home samples to see how far you've gone in that 10 second interval, and in what direction. In order to minimize spurious readings, you must travel at least 30' (9m) in that 10 second interval, or it won't change the track. It WILL always use the current location as the home point, however.

In this example, your compass location is 3 degrees, so you're just a shade past North. The arrow is pointing "up" because you're close to North; if it was pointing to the right you'd be going towards East, down is South, etc.

L/R: Heading to Rocket, Left or Right. This is the way that you need to go (in degrees) from the direction that you're moving, along with an arrow that points you in that direction.

This is what makes the LCD-GPS easy to use. All you basically need to do is to go in the direction of this arrow. As you make course corrections, the arrow will follow, all you need to do is to keep the arrow going straight ahead and it will take you right to your rocket within a few feet. Most of the time that we've flown with the LCD-GPS we spotted the rocket before we got all that close, and that includes recoveries well over a mile away in heavy desert scrub brush.

If the arrow is pointing behind you, that means that you need to turn around. Winds do funny things up in the air… we've had plenty of flights when we were "sure" when the rocket went, and we were 180 degrees off. That's what the Compass heading is good for… during flight, it will show you where you rocket is going, and once it's on the ground you use the Heading to get to it.

In this example, the arrow is pointing UP, which means that you're +/- 22 degrees from the rocket (the arrows move in 45 degree increments). The Heading is L:16, so you need to go 16 degrees to the Left to get to your rocket. If you rotate slightly to the Left and start walking, that number will change, ideally to zero, which means you're going straight towards the rocket. Once it's near zero, just keep going in that directly, and you'll walk right up to your rocket.

This makes it sound harder than it really is… all you need to do is to follow the arrow, and it will take you to your rocket.