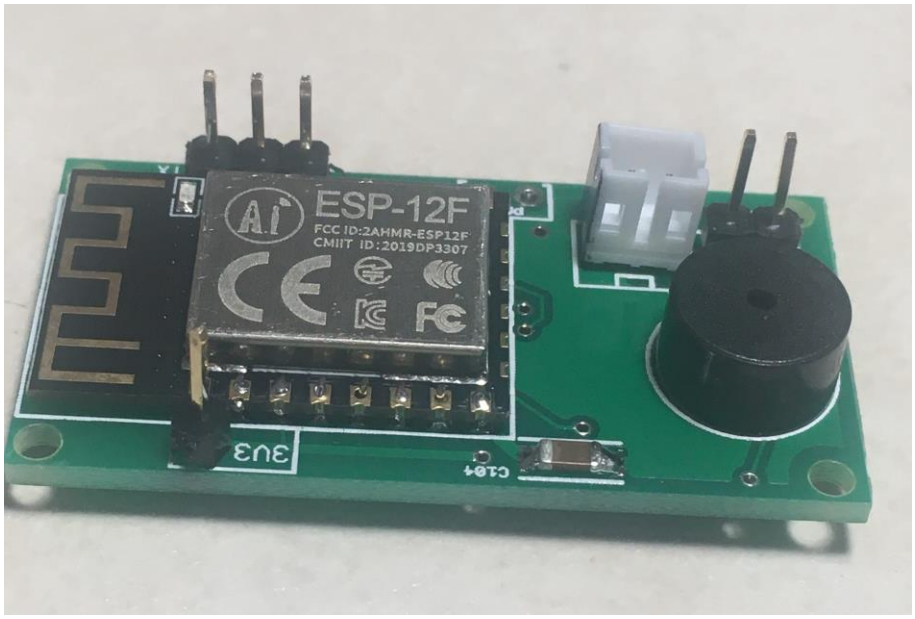
Eggtimer ION
WiFi-Enabled Flight Logger
Assembly Manual

Rev A9



California Proposition 65 Warning

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

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

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

The MSDS can be found at

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

Important Regulatory Information

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

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

Contains FCC ID: 2ADUIESP-12

The Eggtimer ION uses an ESP8266-12 802.11n WiFi module in the 2.4 GHz unlicensed band, per FCC part 15. It is intended to be used only in the United States or other countries in which this band (or a subset of it) is not subject to licensing. We have made a good faith attempt to comply with all technical regulations, and you should too by building it **exactly** as per the instructions, and by not modifying the WiFi module in any way.

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

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

Important Links:

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

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

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Before You Start…

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

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

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Thanks for buying an Eggtimer ION! The ION integrates a data-recording flight computer with a WiFi access point and server, so you can arm for flight, program, and download flight data all from your handheld device. It uses a simple browser interface, so it will work with virtually any wireless device, no apps or other special software required. WiFi range is at least 100' in typical flight conditions. Each ION has a unique WiFi SSID code, and it uses the WPA2-PSK connection protocol with a unique 8-digit passkey, so it's almost impossible for anyone except yourself to connect to your ION and turn it on (or off!). In addition to the saved flight data, you can connect it to the Eggtimer Telemetry Module, to get real-time flight data and milestones such as apogee and maximum velocity.

After your flight, you can view summary flight data right on your handheld device, and you can also download a csv-formatted detail file to your device for analysis using a spreadsheet or other program. It holds your last 15 flights, and numbers each one so you know which one is which.

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

About Soldering Your ION…

Assembling your ION kit isn't that hard, but we recommend that you don't choose it as your first kit project. You must be able to solder small components using fine solder and get nice shiny solder joints. If you have never soldered before, you need to learn anyway, because if you are going to do rocketry electronics you're going to be doing some soldering. If you want to get into advanced projects like telemetry, you're probably going to be doing a lot of soldering. We recommend that you get a few small kits from Ramsey or SparkFun, put them together, and hone your skills on them first. There's a lot of fun stuff out there, so go for it!

The ION uses a number of Surface Mount Technology (SMT) parts, 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 the local hardware store… it's designed for soldering small temperature-sensitive parts without transferring much heat to the part itself.

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

For soldering components on a board like the ION, we recommend a small pencil soldering iron, about 15W. If you are only going to use it occasionally, Weller makes a decent cheap 12W iron, it's about $15. There is also a similar iron that's sold by ECG. We like those, but the copper tips seem to oxidize and corrode rather quickly compared to some more expensive irons; fortunately, the tips are replaceable and cheap. Better would be a fancier soldering pencil with iron tips; those run about $30, but they'll last forever. The best iron would be a temperature-controlled solder station; they typically start at about $50 for a cheap one and can go to a few hundred dollars if you want to get really fancy. Weller makes a good one for about $50, if you make the investment that will probably be the last soldering iron you will ever need to buy. These solder stations usually have a little well with a tip-cleaning sponge, so they end up taking less room on your workstation too. Get the smallest tip you can find, preferably with a conical tip that's about the same width as the smallest pad. .032" (.8 mm) conical tip is ideal. We do NOT recommend that you use an extremely-fine "needle nose" tip, we have found that they may not conduct enough heat to the pads to allow the solder to flow out well. A conical tip with a 1/32" width (.031") should be fine. We recommend that you start at 680F, and go up or down 10F at a time until you find the right temperature for your tip and iron.

General Assembly Information

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

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

___ Small needle-nose pliers

___ Small diagonal cutters

___ Tweezers to handle the SMT parts

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

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

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

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

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

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

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

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

Assembling your ION

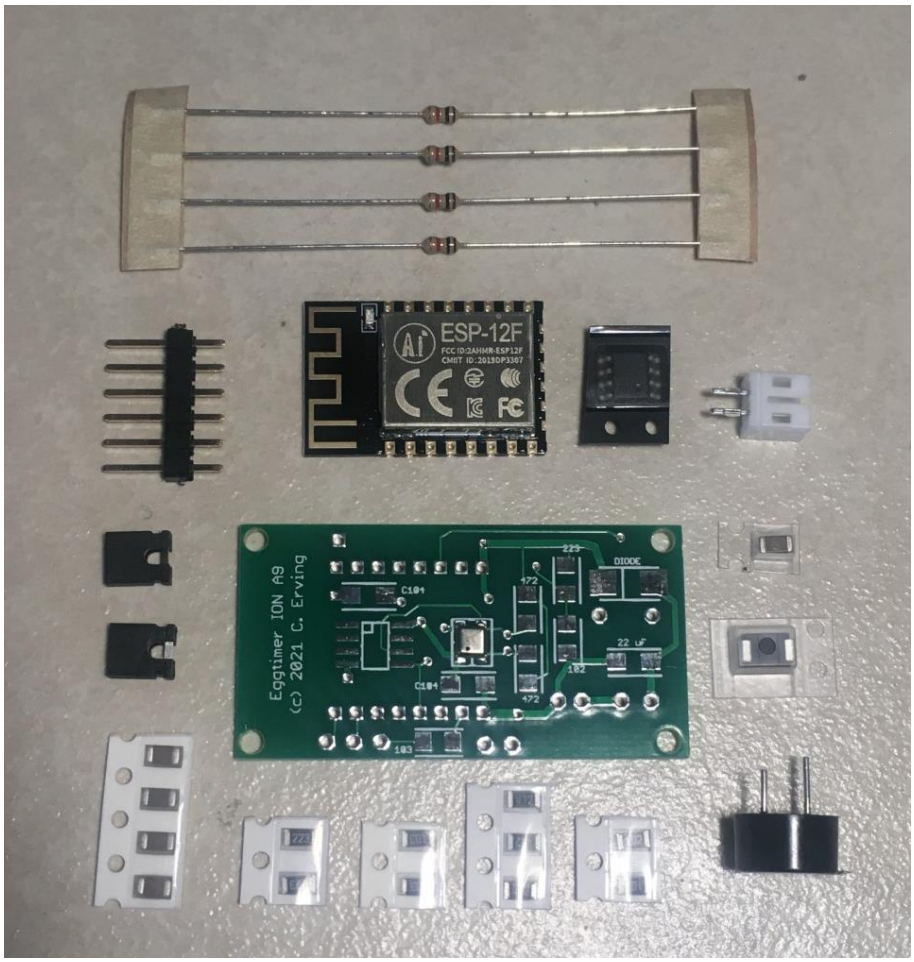
Step 1: Sort the Components

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

Eggtimer ION Parts List Rev A9

	Qty	Description
__	1	Circuit board with pre-mounted pressure sensor
__	1	Pre-programmed ESP8266-12 WiFi Module
__	1	CAT24C512 512 Kb serial EEPROM (8-pin SOIC)
__	1	MBRS130L Rectifier Diode
__	1	1K 1206 resistor (marked "102")
__	2	4.7K 1206 resistor (marked "472")
__	1	10K 1206 resistors (marked "103" or "1002")
__	1	22K 1206 resistor (marked "223")
__	3	.1 uF 1206 ceramic multilayer capacitor (brown) (not marked, but they;re in a PAPER carrier)
__	1	22 uF 1206 ceramic multilayer capacitors (brown) (not marked, but it's in a CLEAR PLASTIC carrier)
__	4	1/8W through-hole resistors (value not important… we're just using them for the leads)
___	1	10mm Magnetic Buzzer
__	1	6-pin header
__	1	2-Pin JST-PH connector (for battery)
__	2	Shorting Jumper (one is a spare)

__ 1 Coil of .020” 63/37 No-Clean solder wire (not pictured)



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 ION 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 ION, however!) Avoid putting it on plastic surfaces that generate static, and preferably put it together in a room that’s not carpeted. (Besides being sources of static electricity, you’ll hate life if you drop one of the little parts in the carpet…) That being said, it’s very unlikely that you will zap any of the components in the ION with static electricity, but consider yourself notified of the possibility…

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

It is very important that you assemble the ION 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. You should ONLY use paper masking tape for that purpose, DO NOT use "Scotch"® tape or electrical tape for this; plastic tapes can pick up static electricity and damage parts, and electrical tape tends to leave a sticky residue.

If you have any questions about the assembly, please send us an email, to support@eggtimerrocketry.com , BEFORE you start building. We generally answer all questions the same day, and we do our best to ensure your success.

Eggtimer ION Assembly Checklist

Before you solder anything, make ***absolutely*** sure that you have the correct part and that it is inserted in the board correctly. The board has all of the component values, outlines, and polarities silk-screened on it, 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 ION 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.

About soldering the resistors and capacitors

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

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

After you've soldered the part in place, inspect the joint carefully with a 10x jeweler's loupe. You should see good solder coverage on the pad with the solder wicking up to side/end of the part, and there should not be any solder splatter or bridges. (Splatter means your iron is too hot… turn it down about 20F and try again). If you don't like what you see, heat up the joints and remove the part, and/or clean it up with some solder wick, and start over.

Alternate Method: Using a Hot Air Tool…

If you've already done a fair amount of SMT work you may have a hot air rework tool. These are very cool, and they can make SMT soldering a lot easier if you have some experience. You can speed up the assembly a bit if you have some no-clean solder paste and a hot air tool. Just put a very small amount on the pads for each part (it shouldn't be blobbed up… you only need a tiny bit), set the part on the pads, then gently go over the pads with your hot air tool. We recommend about 300C to start with, adjust the temperature up or down depending on your

specific paste. Note that we strongly recommend that if you do it this way you use solder paste containing no-clean flux, most of them are that way nowadays, though. We recommend that you do one part at a time, that helps prevent you from accidentally knocking some part off the pads and smearing the solder paste somewhere that you don't want it to be. Note that only about half of the parts are SMT, so you're still going to have to use a soldering iron and the wire for the through-hole parts.

We do NOT recommend that you use a hot air tool to mount the WiFi module. First, you'd need to tape over the vias to prevent the bottom of the module from shorting on them, so the module isn't going to be laying flat against the board. Second, if you get it a little too hot you can damage the WiFi module, and/or loosen the metal RF shield (which is there for FCC compliance), possibly shorting the pads. Just mount it as directed as a through hole part and you'll be fine.

OK, so let's get started…

Mounting the Bottom-Mount SMT Parts

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

__ Orient the board

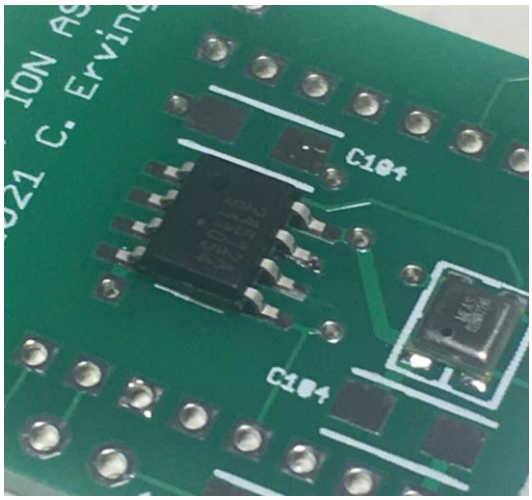
Turn the board so that the pressure sensor is facing up, so that the "Eggtimer ION" logo is to the left. Tape the board down to your work surface with masking tape, on the extreme left and right sides so you don't cover any of the pads.

__ Mount the CAT24C512 EEPROM

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

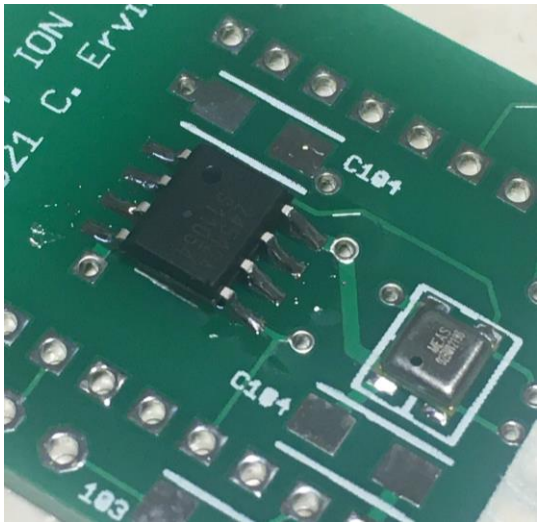
Tin the upper-right pad with just a little bit of solder. With tweezers, hold the EEPROM in place, and heat the lead over the tinned pad until the solder melts. Keep the heat on for another 3-4 seconds, then remove the iron and let the pad cool.

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



Once you're satisfied with the alignment, carefully solder the remaining leads to the pads, waiting 15 seconds between each lead so that the device has a chance to cool down a bit. We recommend that you do the corners first, to help keep the EEPROM in alignment with the pads. When you're done, get out the 10x jeweler's loupe and inspect each solder joint

carefully, making sure that the solder contacts both the pad and the leads, and that there are no solder bridges between the pads. If you find one, get out the solder wick and remove any excess solder before resoldering the pads.

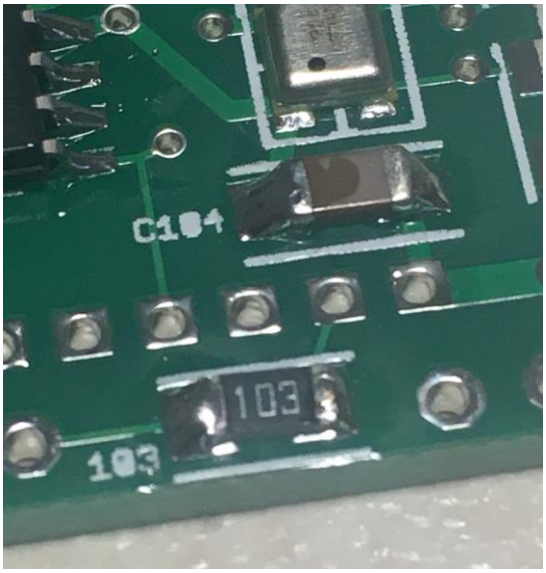


__ Mount the two .1uF capacitors

Locate the spots for the two .1 uF capacitor, one is just above the EEPROM and one is just below the silver baro sensor. These are the brown capacitors that comes in the PAPER tape carrier. Solder in place.

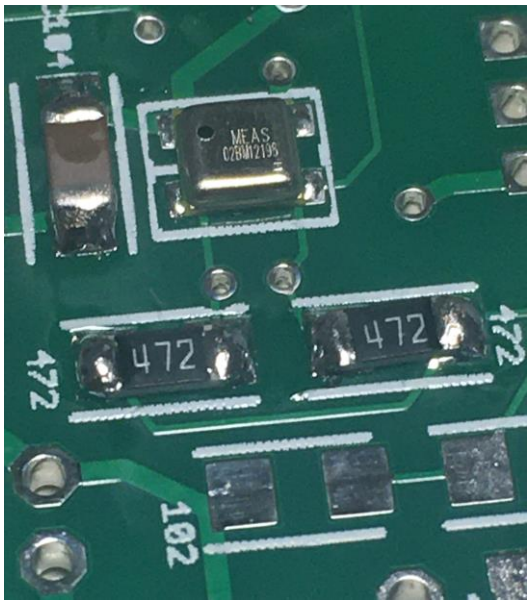
__ Mount the 10K resistor

Locate the 10K resistor (marked 103) that's located at the bottom edge of the board Solder in place.



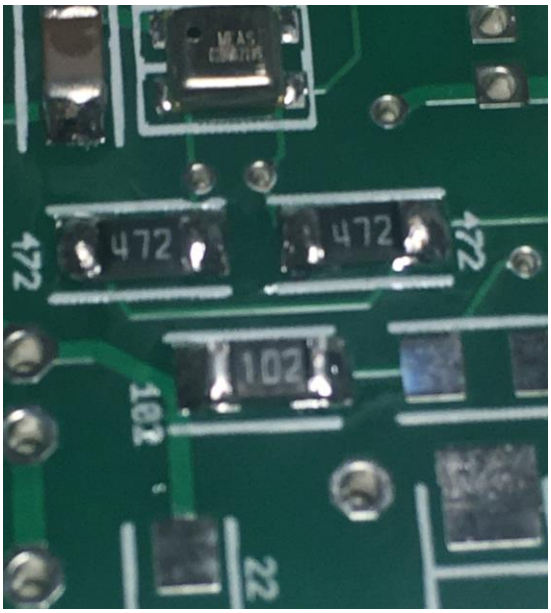
__ Mount the two 4.7K resistors

Locate the 4.7K resistors (marked “472”) near the center of the board. Solder in place.



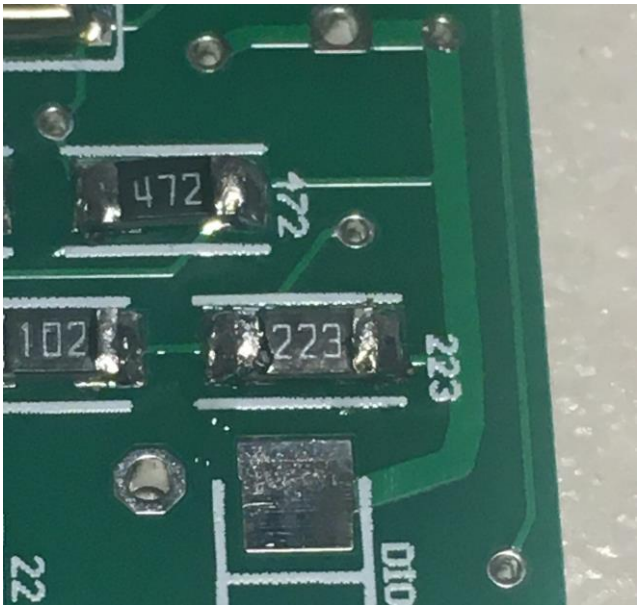
__ Mount the 102 Resistor

Locate the 1K resistor (marked 103) that’s located just to the right of the two 472 resistors that you just soldered. Solder in place.



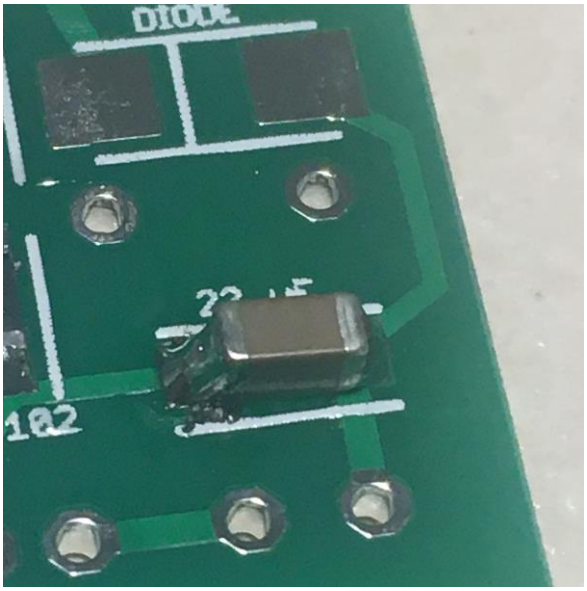
__ Mount the 223 Resistor

Locate the 22K resistor (marked 223) that's located just to the right of the two 472 resistors that you just soldered. Solder in place.



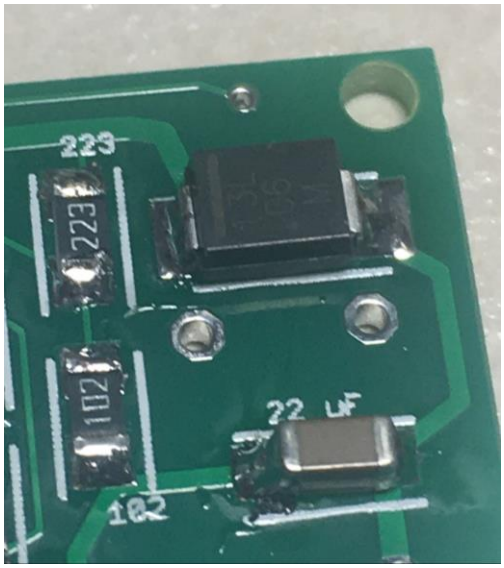
__ Mount the 22 uF Capacitor

Locate the 22 uF capacitor, it's just to the right of the 102 resistor that you just soldered. You can tell the 22 uF capacitor from the other ones because it's the brown unmarked part in the clear plastic carrier (NOT paper). Solder in place.



__ Mount the Diode

Locate the spot for the diode, just above the 22 uF capacitor. You will notice that the left side of the markings has a stripe near the pads. This stripe corresponds to a stripe that's marked on one end of the diode. Make sure that you get the diode pointed in the right direction or your ION won't power up! Solder the diode in place, making sure that the stripe on the diode is facing the LEFT pad.

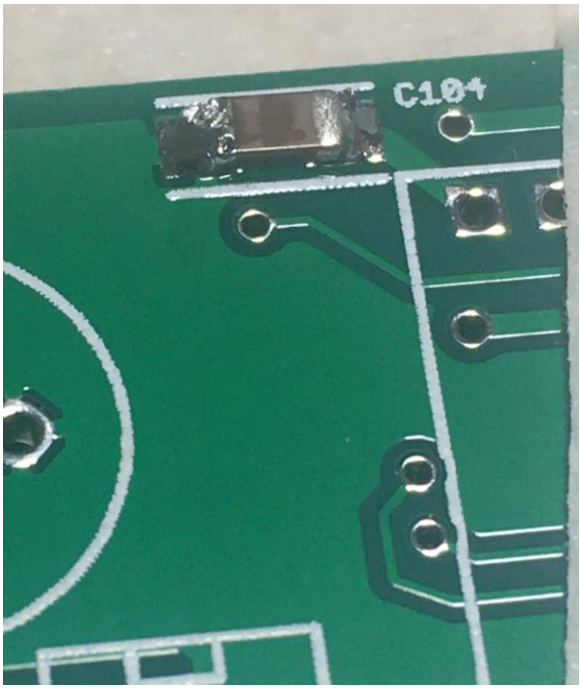


Mounting the Top-Mount Parts

Turn the board over and tape it down, with the outline for the WiFi module on the left side. There is only one surface-mount part on the top side of the board… the rest are all through-hole mount.

__ Mount the .1uF capacitor

Locate the spots for the .1 uF capacitor, at the bottom side of the board. These are the brown capacitors that comes in the PAPER tape carrier. Solder in place.

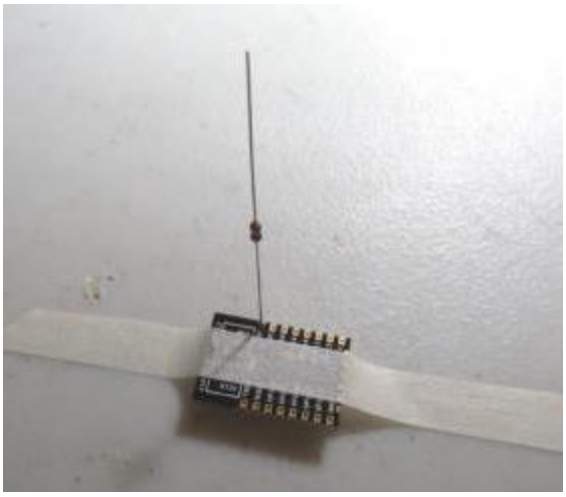


Mounting the ESP8266-12 WiFi Module

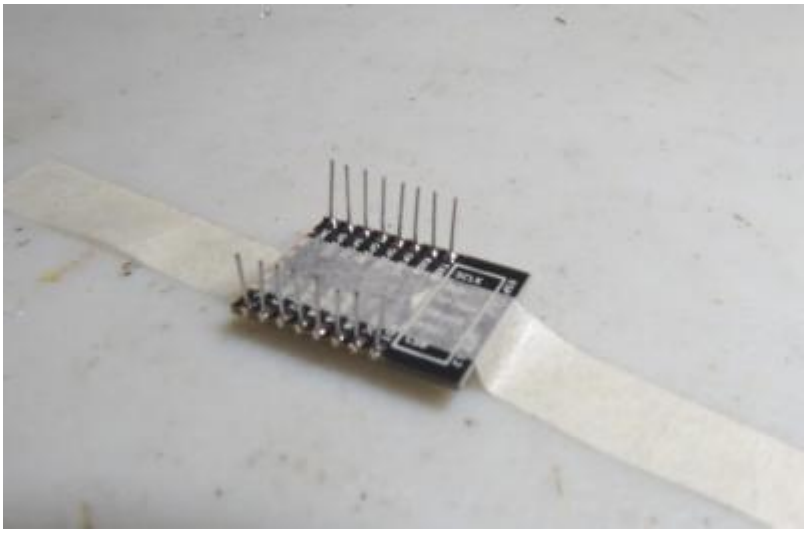
Carefully remove the ESP8266-12 WiFi module from the antistatic baggie in which it was shipped. (Be sure to keep the baggie, it has the passkey that you'll need to connect to your WiFi device!) Note that one end has a "squiggly" line and sticks out, this is the antenna side, be sure to line it up with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

Cut a piece of paper masking tape about ¼" wide and 3" long. Tape the WiFi module to your work tape upside down, so that the metal shield is facing down. Take one of the 1/8W leaded resistors and put it into one of the corner holes of the WiFi module. Yes, it will stick up a lot.

Solder the lead to the pad, holding the resistor straight up, then clip the lead off half-way to the resistor body. You don't need a lot of solder, just enough to fill the hole and ensure that the lead is well attached. Insert the resistor's leads into the next hole, and similarly solder it.

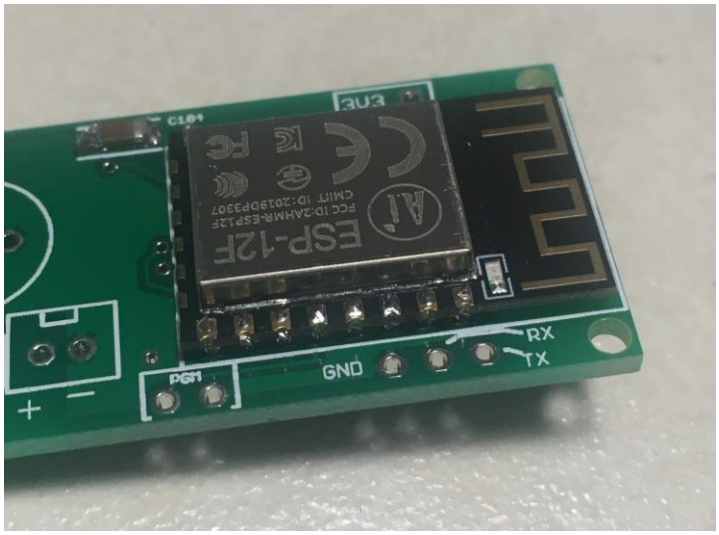


As you clip the resistors' leads, insert it into the next pad, then solder it to that pad. After the second lead on each side, clip it at the resistor body. When you are completely done, there will be a lead on each pad, about ½" long.



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

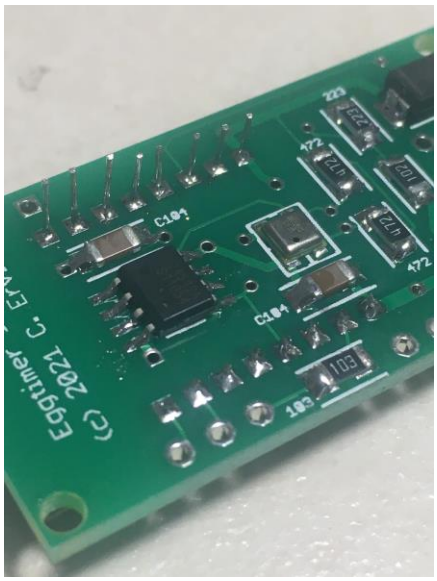
Afterwards, turn the WiFi module over, and with your diagonal pliers even out the leads so that they're the same length. Carefully line up the leads with the holes for the WiFi module markings on the TOP of the PC board, and gently work it into the holes until it's about 1/32" above the board.



Now, turn the board over, and solder the leads to the bottom side of the board. Again, use only enough solder to ensure that you have a good mechanical connection. Clip the leads as you go, making sure that the remnants don't land somewhere on the board.

When you are done, all 16 pads (8 on each side) should be soldered on the bottom of the board. Inspect the solder joints carefully, and touch up any that look incomplete, particularly the two end pads… they provide the power and ground connections from the board.

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

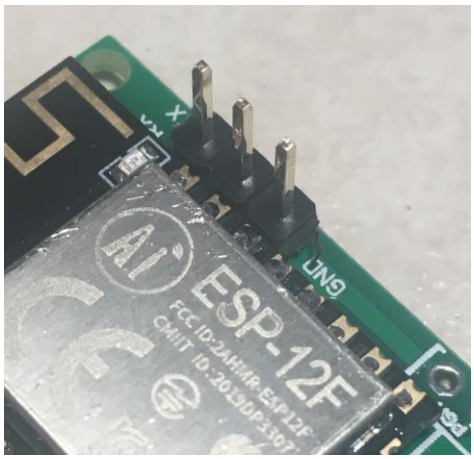


Only one side clipped, for clarity…
Be sure to clip the leads on both sides!

Mounting the Rest of the Top-Mount Parts

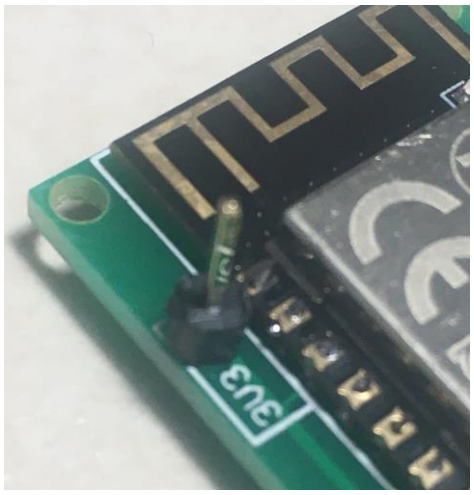
__ Mount the 3-Pin Header

With a pair of small diagonal pliers, clip off three pins from the 6-pin header. Insert the 3-pin header from the top of the board so that the short side goes through the board. Hold it in place with some masking tape, turn the board over, and carefully solder the pins in using just enough solder to bond the pins to the pads.



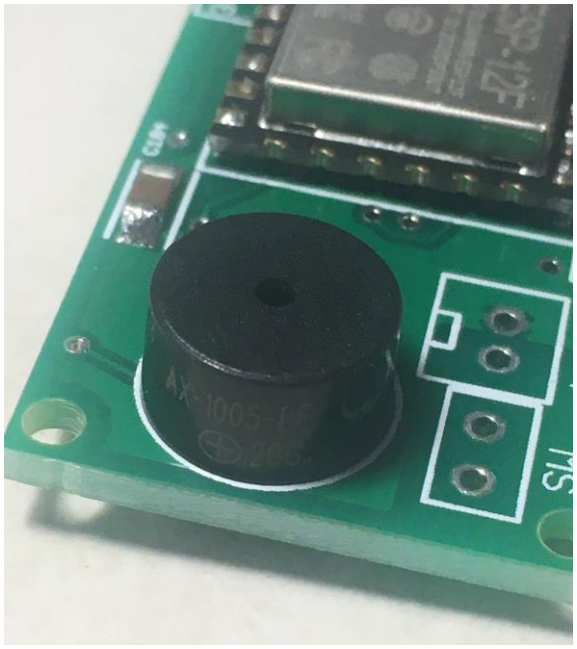
__ Mount the 3V3 Header Pin (optional)

If you are going to be using your Eggtimer ION with an Eggtimer Telemetry Module, you'll need to add a pin to power it. Locate the pad marked "3V3" on the bottom edge of the board. Clip one pin off from the remaining three header pins. Place the pin in the top side of the board so that the shorter end goes through the PC board, tape it in place with some masking tape, then turn the board over and solder the pin in place.



__ Mount the Buzzer

Locate the buzzer, it's on the far right side of the board. Note that it's polarized, one lead is marked "+" and it's also longer than the other lead. Place on the board matching up the "+" with the "+" marking on the board, hold in place with masking tape, then turn over the board and solder in place. Clip the leads flush.



Battery Options…

Now is the time to solder your battery connector. The Eggtimer ION is designed to be used with a 1S/3.7V LiPo battery. We do not recommend using any other battery type, although a 3-cell 3.6V NiMH battery pack will also work (but they're heavier, more expensive, and harder to find so you probably wouldn't want to use one anyway). **DO NOT use any battery over 4V, or you WILL damage your Eggtimer ION!** Whichever battery you decide to use, you must use the matching connector or pigtail, and solder it to the battery pads on your Eggtimer ION board.

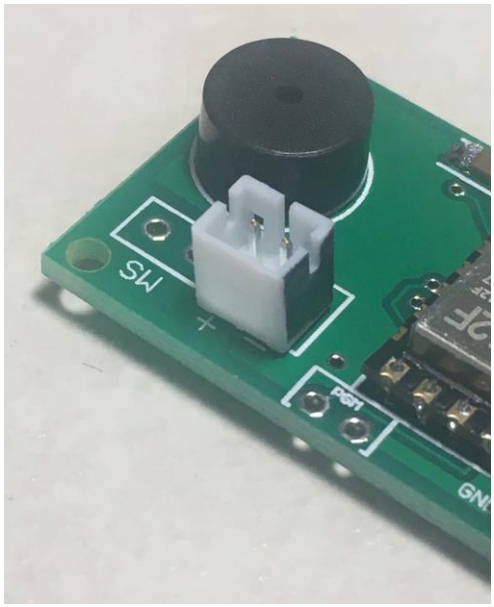
The Eggtimer ION comes with a 2-pin JST-PH connector, which is the connector used by the 400 mAH 1S LiPo SparkFun battery that we recommend. This connector may or may not be the appropriate connector for use with other batteries, and you also need to make sure that any battery that you are using that DOES use a JST-PH connector is wired with the same polarity. In particular, batteries sold by e-Flite using the JST-PH connector are wired BACKWARDS from the SparkFun batteries… you will have to reverse the connector to ensure that it's properly oriented. We recommend that you check the polarity of your battery, regardless of manufacturer and DO NOT mix battery types, since you may damage your Eggtimer ION if you connect the battery backwards!

The battery pads are marked "+" and "-", you need to make sure that your connector is properly installed. We'll have you check it first, then mark the "-" side with a black Sharpie.

For a battery with a JST-PH connector

___ Connect the JST-PH connector to your battery. With a voltmeter, check the polarity of the pins, and mark the side of the connector next to the "-" lead with a black Sharpie marker. It wouldn't hurt to mark the "-" side of the battery, either. Remove the connector from the battery.

___ Insert the JST-PH connector into the top of the board so that the black "-" mark matches up to the "-" pad on the board. Hold it in place with a piece of masking tape, solder the pins to the bottom of the board, then remove the tape.



For a Battery With Some Other Connector

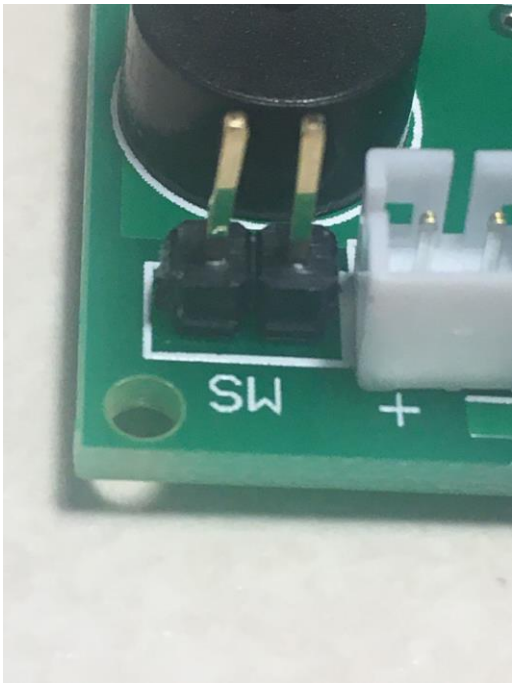
Connect your battery "pigtail" to the battery, then with a voltmeter determine which side is "+" and which side is "-". Normally, the "+" side will be marked RED, and the "-" side will be marked BLACK. Disconnect the battery, then solder the battery pigtail into the two battery pads, making sure that the "+" and "-" leads match up with the markings on the board.

Switch Options…

You have the option of either using the on-board power "switch", which is a simple header which you bridge with a shorting jumper, or adding an external switch (such as a screw switch).

Mount the 2-pin SW Header (for On-Board Switch)

Locate the two SW pads, just to the right of the JST-PH battery connector. Insert the remaining 2-pin header so that the short end goes through the PC board, with the long end sticking up. Tape it in place with some masking tape, then turn the board over and solder the two pins to the pads.



Adding an External Switch

Solder the leads from your external switch to the two pads marked “SW” on the board, next to the battery connector. Note that this is designed for a mechanical switch; if you are going to use some kind of electronic switch (such as the Eggtimer WiFi Switch), we recommend that you consult us first.

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

Connect your battery to the battery connector. If you added an external switch, turn it on; if not, turn it on by pushing one of the included shorting jumpers onto the SW header. You should hear three quick beeps, then a long one. If you do not hear any beeps, immediately disconnect the battery and go to the troubleshooting section. Chances are pretty good that you have a solder bridge or an incomplete joint, so the first thing you need to do is to examine the board thoroughly with a magnifying glass. About 99% of all the problems that we see are due to soldering issues.

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

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

The passkey is an eight-digit number generated by a random number algorithm from the WiFi module's MAC address. It's going to be unique for every ION. There should be a label on the little baggie that the WiFi module came in with the passkey (you kept it, right?), but it's easy to get it if you lose it…

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

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

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

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

ION v1.03J
SSID: ION_F87A6E
PASSKEY:  3718 6501
```

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

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

Now, fire up your device's WiFi manager. Connect the battery to your ION… you'll hear the buzzer beep 3 times then stay on for a second, and in about 5 seconds you should see your ION's SSID on your WiFi manager. Note that the ION will start beeping slowly… just ignore that for now, it's telling you that if you don't connect in 60 seconds it's going to automatically arm for a launch. Connect to the SSID using the passkey that you obtained earlier (but don't put the space between the digits!), and you should see the ION's status page. You're now connected to your ION, and ready to start using it.

Get out the Eggtimer ION User's Guide and start reading… if you can't stand to wait that long, you can cheat by going to the Eggtimer ION Quickstart Guide at the end, but we're sure that you'll want to read the long version for all the information…

Mounting the ION in Your AV Bay

The ION has four #2 holes for mounting in a AV bay sled. It's about 1.7" x .9" x 3/8", so you'll need to make sure that you have enough room on your sled for it. It doesn't matter which way you mount it, as long as it's mounted so the WiFi module is facing outwards. There's a drilling template on the Eggtimer Rocketry web site, we recommend that you download it, print it, and cut it out with scissors so you can drill the mounting holes accurately.

We like to use nylon hardware whenever possible, because it's nonconductive, so you don't have to worry about shorting anything out. If you use metal screws, we strongly recommend that you isolate the board with a nylon washer on each side; you may need two of them to properly raise the bottom of the board off your sled.

Be careful not to overtighten any screws that you use. Since some parts mount on the bottom of the board, it's possible to damage the board if you overtighten them, doing that may break solder joints or even a lead on the IC if it's forced against the sled. Don't ask us how we know this…

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

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

About Batteries for Your ION…

The Eggtimer ION was designed with 1S/4.7V LiPo batteries in mind. The JST-PH connector included with the ION is used by many 1S LiPo batteries, however if you choose to use a battery that uses a different connector MAKE ABSOLUTELY SURE THAT YOU GET THE POLARITY RIGHT. The ION is reverse-polarity protected, but if you connect the battery backwards it's not going to work… that's your first clue that something isn't right. **DO NOT USE ANY BATTERY OVER 4V, OR YOU WILL DAMAGE YOURE ION!**

The ION uses about 60 mA of current, so we recommend that you use a battery with at least 300 mAH of capacity. That will give you about 5 hours of power, which should be enough for almost all flights. Bigger is better. You CAN use a smaller LiPo battery, just remember that the run-time will be less, so if you put a 100 mAH battery in your AV bay and it sits on the pad for two hours, you may have an unpleasant surprise if your battery runs down before your flight. Fortunately, it's easy to monitor the battery voltage of your ION remotely, so this shouldn't happen.

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

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

Troubleshooting

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

Check Your Solder Joints

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

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

Check Your Component Polarity

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

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

If It Still Doesn't Work…

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

Troubleshooting Tips (in approximate order of likelihood)

No power-on beeps when you connect the battery

- Battery polarity backwards
- Bad solder joint on rectifier diode
- Bad solder joint on 22 uF capacitor
- Bad solder joint on the ESP8266-12 module
- Buzzer on backwards

No data when I connect the USB-Serial cable

- Serial cable connected incorrectly
- Terminal program not configured correctly
  (should be 9600 baud, 8 bits, no parity, 1 stop bit)
- Bad solder joint on ESP8266-12 module
- Bad solder joint on header

Don't see a "ION …" SSID

- Bad solder joint on ESP8266-12 module
- Bad solder joint on the .1 uF capacitor next to the WiFi module
- Weak battery (charge before using!)

Can't connect to "ION…" SSID

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

Can't bring up ION web page

- Bad WiFi connection (check your WiFi manager)
- Incorrect URL (use **http://192.168.4.1**)
- Weak battery (use a freshly charged one)
- Bad solder joint on the ESP8266-12 module
- Problem with the two 4.7K resistors next to the baro sensor
- CAT24C512 EEPROM mounted incorrectly

Eggtimer ION Limited Warranty

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

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

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