



Blitzortung

E-Field Kit

Step-by-Step Assembly Instructions

Written for the following PCB Versions ONLY

Pre-Amplifier

PCB Ver. 1b * 4/2014

Amplifier

PCB Ver. 1b * 4/2014

REVISED: July 02, 2014 15:57 PT

[See last page for Revision History](#)

DISCLAIMER: This document is a personal, private endeavor. It is not being written with the approval or sanction of the Blitzortung group. Use of this document is at your own risk.

This document is a work in progress.

Thanks for taking the time to look this document over.

Don McRoberts – W3DRM

Minden, Nevada – USA

NOTE: These instructions appear to be accurate. However, use this document with caution. PLEASE let me know if you find ANY errors of any kind so I can update it and make it more usable for anyone.

No guarantees are made. Use it at your own risk...

These instructions have been put together to assist you in getting started with the assembly of your Blitzortung E-Field kit. A separate document is available for the System RED Lightning Detector kit.

Refer to the above mentioned System RED step-by-step building document for information on suggested tools and supplies you will need during the inventory and assembly phases of the building project. All instructions within this document will assume you have the needed tools and skills to build the kit.

Please take all necessary precautions to mitigate any issues with static discharge prior to beginning your handling of the components included in these kits.

The inventory list will ensure you have a complete kit and are ready to begin with the assembly phase.

A complete list of components and a checklist is available on the Internet to help you inventory your kit. It can be found by going to the WXFORUM.NET web-forum at the following URL:

- <http://www.wxforum.net/index.php?topic=20037.0>

The steps outlined below will help you to complete your inventory, assembly and testing of your new Blitzortung E-Field Kit. This document is laid-out in the following format:

Section I – Inventory your Kit

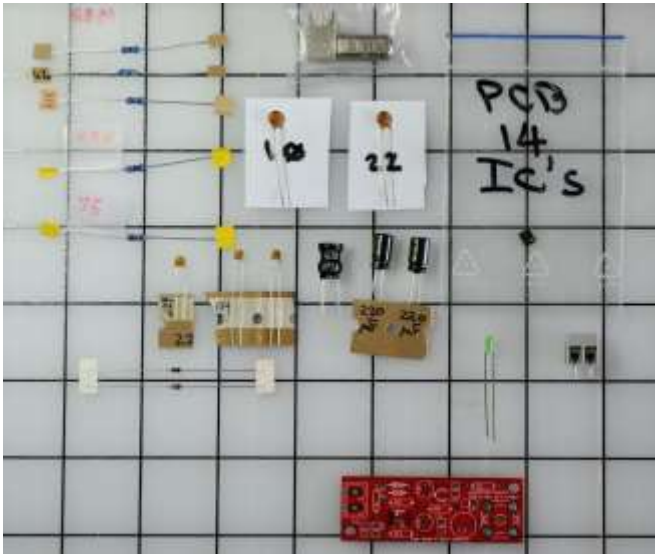
Section II – Assembly of your E-Field Kit

- a) Assemble PCB 14 Pre-Amplifier components
- b) Assemble PCB 13 Amplifier components

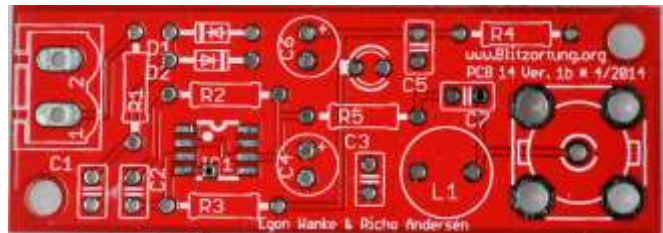
Section III – Testing of your completed Kit

Section IV – Document Revision History

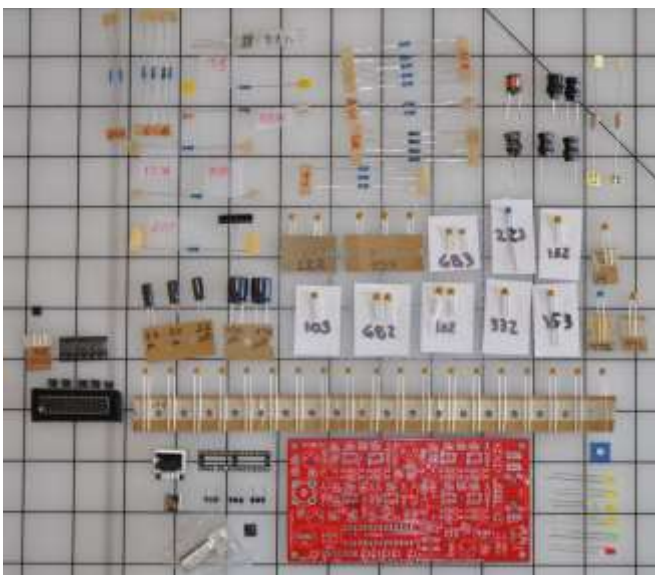
The following are some photos taken of the PCB boards and components after they have been separated into kits for the Pre-Amplifier and Amplifier. All components have been labeled to make it easier to assemble the kits without confusion about part identities.



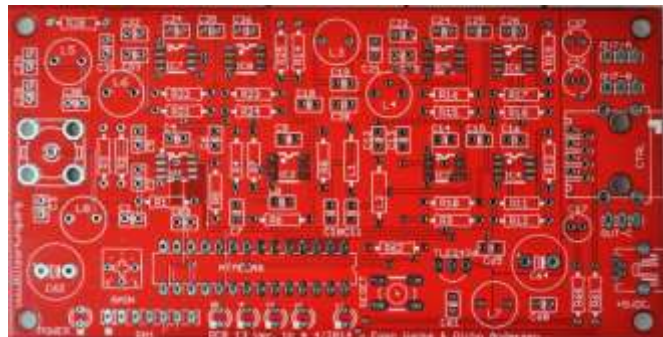
Pre-Amplifier Kit Parts



Pre-Amplifier 14 PCB



Amplifier Kit Parts



Amplifier 13 PCB

GENERAL OVERVIEW FLOW-CHART

Use the following chart to assist you in handling & building your received kits.

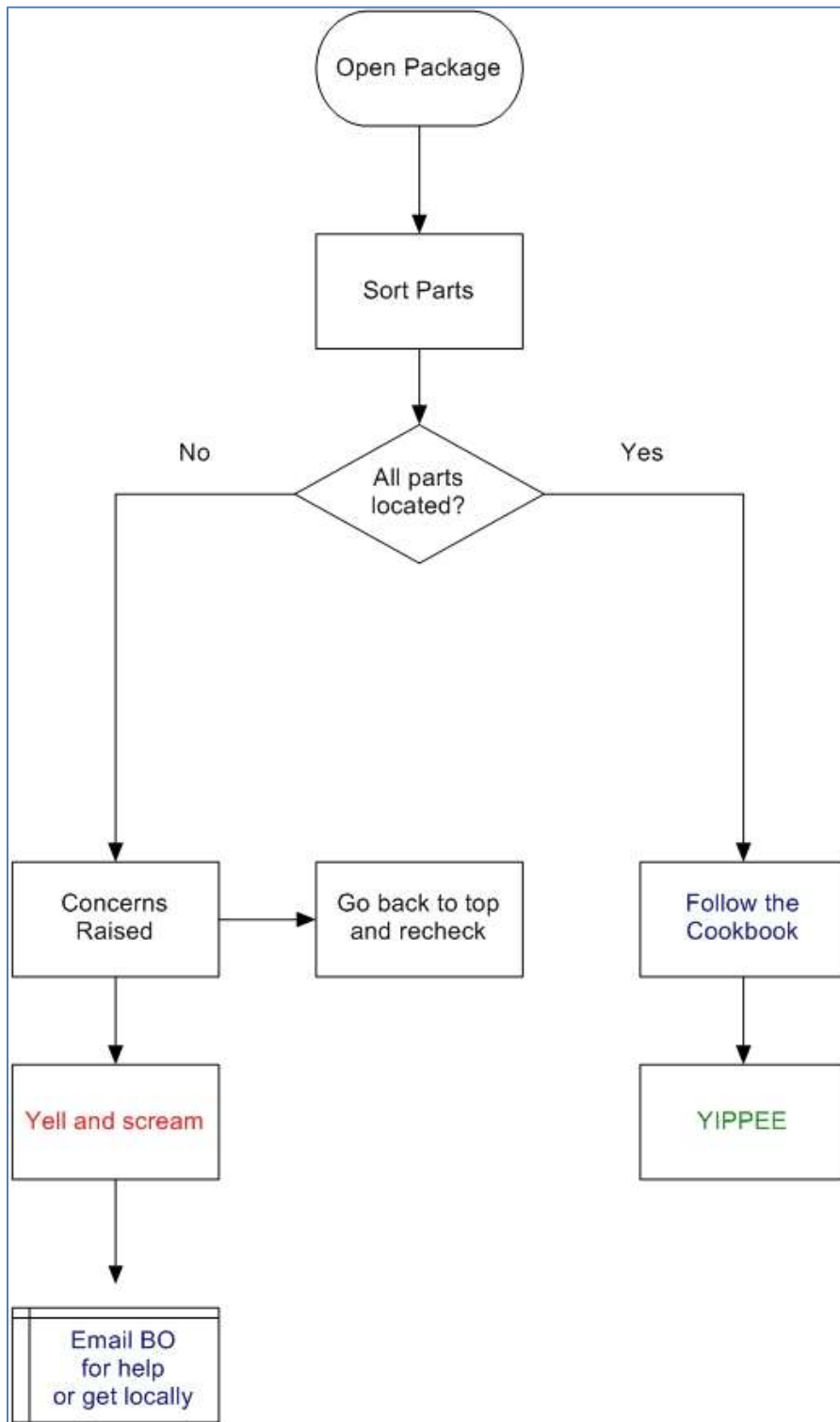


Chart courtesy of Cutty Sark Sailor

SECTION I – INVENTORY YOUR KIT

The Blitzortung E-Field kit will arrive in a box that contains one anti-static plastic bag. The Pre-Amplifier and Amplifier parts are mixed together so it is a good idea to separate the parts into groups for the PCB 14 Pre-Amplifier and another for the PCB 13 Amplifier as you do your inventory. Doing this as you go through the inventory check will make it easier later during assembly.

- a) Start the inventory with the resistors. Using the component check-lists below:
 - a. (<http://carsonvalleyweather.com/blitzortung/docs/System-RED-E-Field-Pre-Amp-14-Ver-1b-Kit-Parts.pdf>)
 - b. (<http://carsonvalleyweather.com/blitzortung/docs/System-RED-E-Field-Amp-13-Ver-1b-Kit-Parts.pdf>)
 - c. Identify and mark each resistor. It is highly recommended that you use a digital multi-meter (DMM) to ensure the correct value of each resistor being identified. The resistors used are very small and the color bands are difficult to see.
- b) Inventory the Capacitors next. On some of these you will not see any value stamped, only a number. The inventory check-list shows those items with their identifying numbers. The latest official version of the Blitzortung System RED Manual (http://www.blitzortung.org/Webpages/index.php?lang=en&page=3®ion=3&subpage_0=30&subpage_3=5&p=3) also has a parts listing along with a few color images of the individual resistors and capacitors to help you identify the various components.
- c) Inventory the IC's, Transistors, LED's & Diodes.
- d) Inventory the Inductors last.
- e) You will also find other non-electronic parts in the bag. These items are listed on the inventory sheets for each board. They can also be identified by viewing the images in the above mentioned System RED manual. I would suggest that you simply lay your Pre-Amplifier and Amplifier boards down with the writing facing up and then temporarily insert each non-electronic component in its place. Do not force any item. If you have problems inserting the part, check the pin alignment to ensure the pins are not bent.
- f) Once you have the items identified and separated, put them in a baggy or some container labeled as "PCB 14 Pre-Amplifier" or "PCB 13 Amplifier" components. This will help when you begin assembling the PCBs.

SECTION II – ASSEMBLY OF YOUR E-FIELD KIT

a) Assembly Sequence – PCB 14 Pre-Amplifier

Check-off each component as you complete it.

1) **Surface Mount Devices (SMDs)**. We'll start with these items so we have plenty of room on the PCB to work. If you are not familiar with soldering of surface mount devices, there are many good videos available on YouTube. Just search for "surface mount soldering tutorial". A good tutorial I have found that covers the basics for various types of SMD devices is www.youtube.com/watch?v=3NN7UGWYmBY. There are many others too.

- a) **SUGGESTION:** Using a fine-tip white or silver marking pen (i.e., Sharpie Metallic – silver pen), place a small dot on the IC by pin #1 so it is easier to align it correctly on the board. You will want to use a magnifying glass or eye-loupe to view the small depression on the IC which identifies pin #1.

IC1 – Op-amp, ADA4891. The dot on the IC must align with the white dot on the Pre-Amplifier PCB. Solder one of the corner pins first to hold the IC in place. Once it is aligned correctly so that all pins are on their corresponding pads, solder the remaining pins.

Congratulations! You have completed the most difficult part of assembling the components on the Pre-Amplifier board.

We will now begin inserting and soldering the smaller components in their respective positions on the Pre-Amplifier board.

2) Diodes – 1N4148

The cathode (-) of the diode is marked with a black or white ring on the body of the diode itself. This side is marked white on the PCB along with the component number ie (D1, D2). Bend the leads on each diode by holding each lead next to the glass body with a pair of needle-nose pliers. This will eliminate stressing the diode which may possibly crack it. Insert each diode all the way in until it touches the PCB. Slightly spread the leads on the back-side of the PCB so the diode does not fall-out. Do not solder until both diodes have been inserted.

- D1 – 1N4148 diode.** Prepare and insert the diode into the designated holes on the PCB.
- D2 – 1N4148 diode.** Follow the instructions as described above.
- Solder both diodes just inserted.
- Clip the leads on the backside of the PCB for both diodes.

NOTE: During the following assembly steps for both the E-Field Pre-amplifier and Amplifier PCB's, use your own judgment as to when to actually solder the components. In some cases you may want to insert several components before soldering them in a batch mode. The steps that follow mostly say to insert but don't say to solder each component. It is assumed that you will make that decision on your own.

3) Resistor Installation

We will now begin inserting and soldering the resistors on the Pre-Amplifier board.

We'll start on the left-side of the PCB with it oriented so the antenna input section is on the left. R1 will be in the upper left-side of the PCB. The resistors can be inserted in any direction. I suggest inserting only a few at a time so it is easier to solder and clip the leads as you go. Bend the leads as you did with the diodes earlier.

- R1 10K Ω** Prepare and insert the resistor into the designated holes on the PCB.
- R2 4.7M Ω** Follow the instructions as described above.
- R3 6.8M Ω** Follow the instructions as described above.
- R5 75 Ω** Follow the instructions as described above.
- R4 4.7K Ω** Follow the instructions as described above.

Go back over all of the resistors to be certain they have been soldered and have their excess leads clipped from the back of the PCB.

4) LEDs

- Green Power** Align long lead with white mark on PCB.

Solder and then clip the excess lead length.

5) Non-Electrolytic Capacitor Installation

We will now begin inserting and soldering the non-polarized capacitors on the Pre-Amplifier board.

We'll start on the left-side of the PCB as we did with the resistors. The only difference in the process is that you will not have to pre-bend the leads. They should fit nicely into the PCB as they are. You will still have to spread the leads on the backside of the PCB to hold the capacitors into place for soldering. As with the resistors, I suggest inserting only a few at a time so it is easier to solder and clip the leads as you go.

- C1** **22pF** **(22)** Insert the capacitor into the designated holes on the PCB.
- C2** **10pF** **(10)** Follow the instructions as described above.
- C3** **100nF** **(104)** Follow the instructions as described above.
- C5** **100nF** **(104)** Follow the instructions as described above.
- C7** **220nF** **(224)** Follow the instructions as described above.

Go back over all of the capacitors to be certain they have been soldered and have their excess leads clipped from the back of the PCB.

6) Electrolytic Capacitor Installation

Electrolytic capacitors must be installed with the correct pin alignment. The capacitors have a stripe mark on the side. This stripe indicates the negative side of the cap. Insert the lead on the *non-striped* side into the hole marked with a "+" next to it.

- C6** **220 μ F** Insert as noted above.
- C4** **220 μ F** Insert as noted above.

Go back over all of the electrolytic capacitors to be certain they have been soldered and have their excess leads clipped from the back of the PCB.

7) Inductors

- L1** **4.7mH (472)** Insert the inductor into the designated holes on the PCB.

8) Miscellaneous Components

- P1** **Antenna Terminal Block** Insert the terminal block so the openings for the antenna wiring is facing away from the PCB.
- F-Connector** Install so the threads are pointing away from the PCB.

SPECIAL NOTE FROM “Cutty Sark Sailor” (Mike)

IMPORTANT: **BE CAREFUL** with your Female F Connectors! Several early kit builders have had them come apart resulting in broken conductors. The threaded portion is pressed into the housing, and appears to take little effort to separate them. **DO NOT** over tighten when attaching the coaxial cable.

Congratulations – You have now finished assembly and soldering of your E-Field Pre-Amplifier PCB!

If desired, you may use Denatured Alcohol to clean off any solder flux residue on the PCB. Be certain to wipe it off and remove any debris on the board afterwards. Take a close look at the board to ensure all components have been soldered correctly and that no solder-bridges exist between components or etches.

You may now set this board aside as you prepare to assemble the Amplifier board next. We will test this board after the Amplifier PCB is assembled and tested.

b) Assembly Sequence – PCB 13 Amplifier

Check-off each component as you complete it.

1) **Surface Mount Devices (SMD)**. We'll start with these items so we have plenty of room on the PCB to work.

SUGGESTION: Using a fine-tip white or silver marking pen (i.e., Sharpie Metallic – silver pen), place a small dot on the IC so it is easier to align it correctly on the board. You will want to use a magnifying glass or eye-loupe to view the small depression on the IC which identifies pin #1.

When placing the SMD IC, the dot on the IC must align with the white dot on the Pre-Amplifier PCB. Solder one of the corner pins first to hold the IC in place. Once it is aligned correctly so that all pins are on their corresponding pads, solder the remaining pins.

- | | | | |
|--------------------------|------------|----------------|--|
| <input type="checkbox"/> | IC7 | MCP6S91 | Place on the PCB and solder as instructed above. |
| <input type="checkbox"/> | IC1 | MCP6S91 | Place on the PCB and solder as instructed above. |
| <input type="checkbox"/> | IC8 | LMH6642 | Place on the PCB and solder as instructed above. |
| <input type="checkbox"/> | IC2 | MCP6292 | Place on the PCB and solder as instructed above. |
| <input type="checkbox"/> | IC5 | MCP6S91 | Place on the PCB and solder as instructed above. |
| <input type="checkbox"/> | IC3 | MCP6S91 | Place on the PCB and solder as instructed above. |
| <input type="checkbox"/> | IC6 | LMH6642 | Place on the PCB and solder as instructed above. |
| <input type="checkbox"/> | IC4 | LMH6642 | Place on the PCB and solder as instructed above. |

This completes the placement and soldering of the SMD IC's on the Amplifier board. Check to make certain there are no solder bridges between the pins on the IC's. Use a magnifier to check the pins.

2) Resistor Installation

We will now begin inserting and soldering the resistors on the Amplifier board.

We'll start on the left-side of the PCB with it oriented so the antenna input section is on the left. R20 will be in the upper left-side of the PCB. The resistors can be inserted in any direction. I suggest inserting only a few at a time so it is easier to solder and clip the leads as you go. Bend the leads as you did with the diodes earlier.

- | | | | |
|--------------------------|------------|--------------|---|
| <input type="checkbox"/> | R20 | 180Ω | Prepare and insert the resistor into the designated holes on the PCB. |
| <input type="checkbox"/> | R3 | 10KΩ | Follow the instructions as described above. |
| <input type="checkbox"/> | R2 | 100KΩ | Follow the instructions as described above. |
| <input type="checkbox"/> | R1 | 75Ω | Follow the instructions as described above. |
| <input type="checkbox"/> | R22 | 22KΩ | Follow the instructions as described above. |
| <input type="checkbox"/> | R21 | 1KΩ | Follow the instructions as described above. |
| <input type="checkbox"/> | R5 | 39KΩ | Follow the instructions as described above. |
| <input type="checkbox"/> | R23 | 100KΩ | Follow the instructions as described above. |
| <input type="checkbox"/> | R24 | 10KΩ | Follow the instructions as described above. |
| <input type="checkbox"/> | R4 | 27KΩ | Follow the instructions as described above. |
| <input type="checkbox"/> | R7 | 39KΩ | Follow the instructions as described above. |
| <input type="checkbox"/> | R6 | 12KΩ | Follow the instructions as described above. |
| <input type="checkbox"/> | R25 | 47Ω | Follow the instructions as described above. |
| <input type="checkbox"/> | R14 | 220Ω | Follow the instructions as described above. |
| <input type="checkbox"/> | R8 | 1KΩ | Follow the instructions as described above. |
| <input type="checkbox"/> | R62 | 10KΩ | Follow the instructions as described above. |

- R16 22K Ω** Follow the instructions as described above.
- R15 1K Ω** Follow the instructions as described above.
- R10 22K Ω** Follow the instructions as described above.
- R9 1K Ω** Follow the instructions as described above.
- R17 100K Ω** Follow the instructions as described above.
- R18 10K Ω** Follow the instructions as described above.
- R11 100K Ω** Follow the instructions as described above.
- R12 10K Ω** Follow the instructions as described above.
- R19 47 Ω** Follow the instructions as described above.
- R13 47 Ω** Follow the instructions as described above.
- R60 330 Ω** Follow the instructions as described above.
- R61 330 Ω** Follow the instructions as described above.

Go back over all of the resistors to be certain they have been soldered and have their excess leads clipped from the back of the PCB.

3) Non-Electrolytic Capacitor Installation

We'll start on the left-side of the PCB as we did with the resistors. Don't forget to spread the leads on the backside of the PCB to hold the capacitors into place for soldering. As with the resistors, I suggest inserting only a few at a time so it is easier to solder and clip the leads as you go.

- | | | | | |
|--------------------------|------------|---------------|--------------|---|
| <input type="checkbox"/> | C29 | 33 nF | (333) | Insert the capacitor into the designated holes. |
| <input type="checkbox"/> | C28 | 22 nF | (223) | Follow the instructions as described above. |
| <input type="checkbox"/> | C3 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C30 | 68 nF | (683) | Follow the instructions as described above. |
| <input type="checkbox"/> | C31 | 10 nF | (103) | Follow the instructions as described above. |
| <input type="checkbox"/> | C32 | 68 nF | (683) | Follow the instructions as described above. |
| <input type="checkbox"/> | C33 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C5 | 3.3 nF | (332) | Follow the instructions as described above. |
| <input type="checkbox"/> | C2 | 1.0 nF | (102) | Follow the instructions as described above. |
| <input type="checkbox"/> | C1 | 220 nF | (224) | Follow the instructions as described above. |
| <input type="checkbox"/> | C34 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C4 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C63 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C35 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C6 | 1.0 nF | (102) | Follow the instructions as described above. |
| <input type="checkbox"/> | C36 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C7 | 4.7 nF | (472) | Follow the instructions as described above. |
| <input type="checkbox"/> | C18 | 15 nF | (153) | Follow the instructions as described above. |

- | | | | | |
|--------------------------|------------|---------------|--------------|---|
| <input type="checkbox"/> | C9 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C8 | 1.5 nF | (152) | Follow the instructions as described above. |
| <input type="checkbox"/> | C19 | 6.8 nF | (682) | Follow the instructions as described above. |
| <input type="checkbox"/> | C20 | 33 nF | (333) | Follow the instructions as described above. |
| <input type="checkbox"/> | C10 | 470 pF | (471) | Follow the instructions as described above. |
| <input type="checkbox"/> | C11 | 2.2 nF | (222) | Follow the instructions as described above. |
| <input type="checkbox"/> | C21 | 2.2 nF | (222) | Follow the instructions as described above. |
| <input type="checkbox"/> | C12 | 6.8 nF | (682) | Follow the instructions as described above. |
| <input type="checkbox"/> | C22 | 33 nF | (333) | Follow the instructions as described above. |
| <input type="checkbox"/> | C23 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C13 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C24 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C14 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C61 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C25 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C15 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C65 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C26 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C16 | 100 nF | (104) | Follow the instructions as described above. |
| <input type="checkbox"/> | C60 | 100 nF | (104) | Follow the instructions as described above. |

Go back over all of the capacitors to be certain they have been soldered and have their excess leads clipped from the back of the PCB.

4) IC Socket

The ATMEGA8 IC socket needs to be installed next to allow for easier installation of the surrounding components

- IC Socket Check to be certain that the pins of the socket are straight and then insert in the PCB holes and solder.

Check to be certain all pins have been soldered and that there are no solder bridges between the pins.

5) LEDs

Align long lead with white mark on PCB.

- Power LED Red Insert LED aligned as described above.
- Control LED Green Insert LED aligned as described above.
- Gain LED-1 Yellow Insert LED aligned as described above.
- Gain LED-2 Yellow Insert LED aligned as described above.
- Gain LED-4 Yellow Insert LED aligned as described above.
- Gain LED-8 Yellow Insert LED aligned as described above.

Solder each LED and then clip the excess lead length.

6) Inductors (w/axial leads)

- L1 1.5 mH Insert the inductor into the designated holes on the PCB.
- L2 3.3 mH Insert the inductor into the designated holes on the PCB.

7) Miscellaneous components

- RN1 **1kΩA102(102G)** Insert the resistor network into the designated holes on the PCB.
- P1 **50KΩ Pot** Insert the potentiometer into the designated holes on the PCB.
- IC9 **TLE-2426** Insert the component into the designated holes aligning the flat-side with the markings on the PCB.

8) Inductors (w/radial leads)

- L5 **1.5 mH (152)** Insert the inductor into the designated holes on the PCB.
- L6 **2.2 mH (222)** Insert as described above.
- L8 **4.7 mH (472)** Insert as described above.
- L3 **1 mH (102)** Insert as described above.
- L4 **1 mH (102)** Insert as described above.
- L7 **470/330 μH (Wire windings are visible)** Insert as described above.

9) Electrolytic Capacitor Installation

Electrolytic capacitors must be installed with the correct pin alignment. The capacitors have a stripe mark on the side. This stripe indicates the negative side of the cap. Insert the lead on the ***non-striped*** side into the hole marked with a “+” next to it.

- C62 **470 μ F** Insert as noted above.
- C64 **470 μ F** Insert as noted above.
- C37 **2.2 μ F** Insert as noted above.
- C27 **2.2 μ F** Insert as noted above.
- C17 **2.2 μ F** Insert as noted above.

Go back over all of the electrolytic capacitors to be certain they have been soldered and have their excess leads clipped from the back of the PCB.

10) Miscellaneous Components

- Out-A Output Test Connector Insert the connector on the PCB.
NOTE: The short side of the leads go into the PCB holes.
- Out-B Output Test Connector Insert the connector as above.
- Out-C Output Test Connector Insert the connector as above.
- USB Mini Connector Insert the connector on the PCB.
- RJ-45 Ethernet Connector Insert the connector on the PCB.
- Reset Button Insert the push button on the PCB.
- F-Connector Install so the threads are pointing away from the PCB.

We will now insert the ATMEGA8 Microprocessor controller IC into its socket.

NOTE: Ensure all pins on the IC are straight and not bent. You will not be able to fully insert it if any of the pins are not lined-up with the socket.

11) IC Component Insertion

a. Microprocessor Controller

- ATMEGA8** Insert the IC into the designated socket.

This concludes the assembly of the E-Field Amplifier 13 Version 1b PCB.

You may use Denatured Alcohol to clean off any solder flux residue on the PCB. Be certain to wipe it off and remove any debris on the board afterwards.

SECTION III – INITIAL TESTING OF YOUR E-FIELD KIT

1) PCB 14 Pre-Amplifier & PCB 13 Amplifier Testing

Check-off each step as you complete it.

- Connect a length of coaxial cable between the E-Field pre-amplifier board and the E-field amplifier using the F-connectors (do not over tighten these connectors). No antenna need be connected at this time.
- Connect a length of shielded Ethernet cable with RJ45 connectors between the existing RED system Controller PCB and the new E-Field Amplifier PCB. Power for the E-field PCB's will be supplied through this cable.

You should see the Red LED lit indicating power is being supplied to the PCB and the four Yellow LEDs should blink four times in unison. After the Yellow LEDs stop blinking, they will stay in a random pattern that is dependent on the position of P1, the manual gate adjustment potentiometer. The Green LED will come on after the Yellow LEDs stop blinking. Pressing the RESET button next to the Green LED will cause the Yellow LEDs to blink four times with each press.

The Green LED on the Pre-amp PCB should come on somewhat dimly and remain on.

If you do not get the above results,

- Check all solder joints again,
- Check the ATMEGA8 IC to ensure it is fully seated in its socket and that none of the pins are bent,
- Ensure there are no solder bridges between circuit components. Use a bright lamp and magnifying glass, if necessary.

SECTION IV – DOCUMENT REVISION HISTORY

Revision History:

- June 13, 2014
 - Updated cover page Blitzortung image to current people version.

- June 16, 2013
 - Miscellaneous document corrections
 - Initial writing of the testing portion of the document.