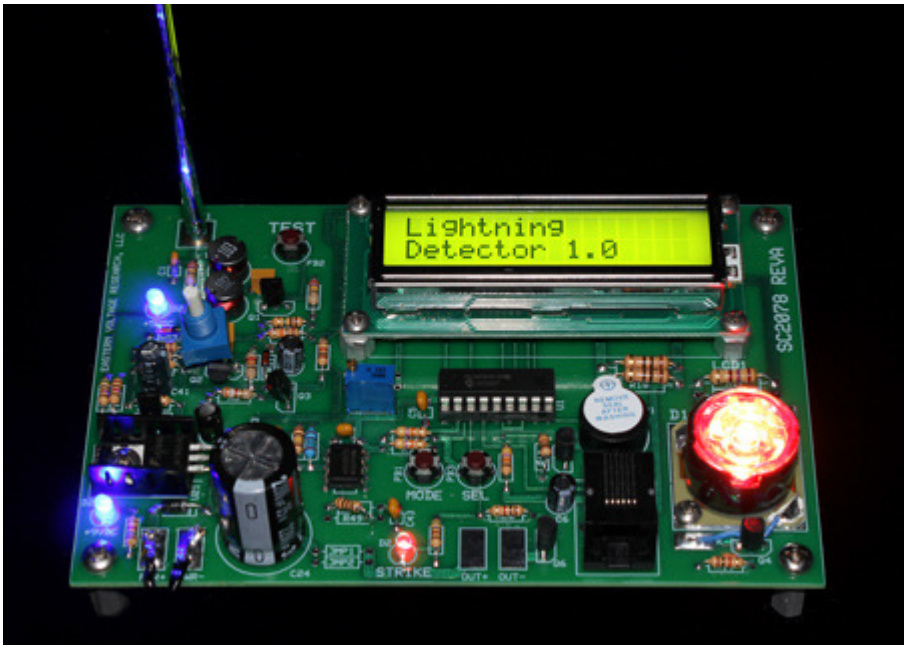
Lightning Detector 1.0



Instruction Manual

Eastern Voltage Research, LLC

SAFETY DISCLAIMER

THIS KIT IS FOR HOBBY / NOVELTY USE ONLY. IT IS NOT DESIGNED, NOR SHOULD BE USED FOR, PERSONAL PROTECTION, EQUIPMENT PROTECTION, OR SCIENTIFIC USE.

Introduction to the Lightning Detector 1.0

Thank you for purchasing the Lightning Detector 1.0 Kit. The Lightning Detector 1.0 is designed to detect and count lightning strikes from nearby storms up to several miles away. It does this by detecting the electromagnetic pulse produced by a lightning strike. When a lightning strike occurs, a huge amount of energy is produced which is radiated across the entire electromagnetic spectrum. By using an antenna, this kit can detect those electromagnetic pulses and thus determine that lightning strikes have occurred.

Notice to Beginners: If you are first time kit builder, you may find this instruction manual easier to understand than expected. Each component in this kit has an individual check box, while a detailed description of each component is provided as well. If you follow each step in the instruction manual in order, and practice good soldering and kit building skills, the kit is next to fail-safe.

Please read this manual in its entirety before building, testing, or operating your kit!

Circuit Description

The Lightning Detector 1.0 is a very straightforward circuit, comprised of only a few major subcircuits. The detection portion of this circuit is based (and used by permission) on a RF tank circuit developed by Charles Wenzel. The RF tank circuit, comprised of inductors L1 and L2, capacitor C1, resistor R1, and antenna, ANT1 is tuned to 300kHz. This basically means that the antenna detection circuit is most sensitive to RF energy occurring at that frequency, and any RF energy present around that frequency band will be detected and registered as a lightning strike. Why 300kHz? That's a good question. 300kHz is used because it's a relatively "silent" portion of the electromagnetic spectrum, meaning that the circuit will be less prone to false triggers which could occur to other RF devices operating in the vicinity including cell phones, radios, wireless computers, etc… R1 of the tank circuit is used to control the Q of the tank circuit and can be varied to increase or decrease the overall sensitivity of the circuit. Raising and lowering the antenna can also have a similar effect.

The subcircuit comprised of Q2 and Q3 simply produces a one-shot pulse which is sent to the microprocessor, U1, when a lightning strike is detected. The microprocessor will then register the strike and illuminate an LED and / or sound a buzzer to alert the user that a strike has occurred. The 16x2 character LCD display then displays that information to the user.

The circuit created by Q41 is a simple integration filter circuit which outputs an analog voltage level based on the frequency of lightning strike occurrence. For example, if a lightning strikes only 1 time every 10 seconds on average during a particular storm, the voltage level will be very low. On the other hand, if lightning is striking 2 times per second during a storm, this voltage level output will be high. (Max. level is approximately 2.5V) This analog voltage is then sent to the microprocessor where it is recorded and displayed as a storm intensity level on the 16x2 character LCD display. The user can program the gain settings for this intensity indicator in the set-up menu.

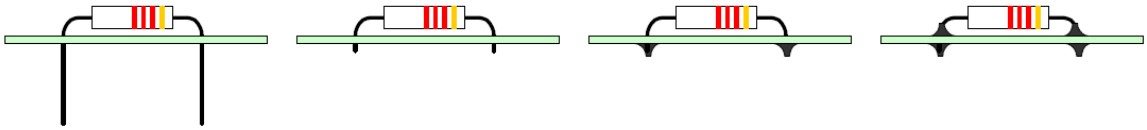
Finally, U21 is a simple 5V linear regulator which converts the incoming 9V to 5V which is used by the lightning detection circuit and microprocessor.

Kit Building Tips

A good soldering technique is key! Let your soldering iron tip gently heat both the wires and pads simultaneously. Apply solder to the wire and the pad when the pad is hot enough to melt the solder. The finished joint should appear like a small shiny drop of water on paper, somewhat soaked in. If the pads have not heated up sufficiently, melted solder (heated only by the soldering iron itself) will form a cold solder joint and will not conduct properly. These cold joints appear as dull beads of solder, and can be easily fixed by applying additional heat to the pad and wire. All components, unless otherwise noted, should be mounted on the top side of the board. This is the side with the silkscreen printing.

When installing components, the component is placed flat to the board and the leads are bent on the backside of the board to prevent the part from falling out before soldering. The part is then soldered securely to the board, and the remaining lead length is clipped off. It is also extremely important to place the components as close to the board as possible. This is necessary for proper operation over the wide frequency range of the various kits we provide. Also be sure that component lead lengths are always as short as possible. This will avoid adding any stray capacitances or inductances that can be detrimental to circuit operation.

An alternative approach (which is actually the one I use) is to install the component into the board and then apply a piece of masking tape on the topside to the hold the component in place temporarily. The leads on the backside of the board are then trimmed leaving about 0.10” lead protruding through the backside of the board, and then soldered from the backside. You can then remove the masking tape, and finally apply a small amount of solder on the top to complete the joint on both sides. This is shown in the figure below.



Lightning Detector 1.0 Parts List

RESISTORS

❒	2	270k Resistor (red-violet-yellow), R1, R3
❒	2	1Meg Resistor (brown-black-green), R2, R42
❒	1	10k Resistor (brown-black-orange), R4
❒	1	82k Resistor (gray-red-orange), R5
❒	1	3.9k Resistor (orange-white-red), R6
❒	5	1k Resistor (brown-black-red), R7, R13, R20, R44, R45
❒	3	47k Resistor (yellow-violet-orange), R8, R9, R10
❒	2	560 ohm Resistor (green-blue-brown), R11, R22
❒	2	10 ohm Resistor, 1/2W (brown-black-black), R16, R18
❒	1	1.5k Resistor (brown-green-red), R21
❒	1	8.66k Resistor, 1% (gray-blue-blue-brown-brown), R14
❒	1	1.40k Resistor, 1% (brown-yellow-black-brown-brown), R15
❒	1	100k Resistor (brown-black-yellow), R41
❒	1	10Meg Resistor (brown-black-blue), R43
❒	1	1Meg, Potentiometer, R23
❒	1	0 ohm Jumper Resistor (single black stripe), CR23
❒	1	1k Resistor (brown-blue-black), R19 (1.5 Kit Only)
❒	1	16 ohm Resistor, 1/2W (brown-blue-black), R17 (1.5 Kit Only)

CAPACITORS

❒	1	10pF Ceramic Capacitor, C1
❒	1	1000pF Ceramic Capacitor, C2
❒	1	100pF Ceramic Capacitor, C3
❒	2	10uF, 50V Electrolytic Capacitor, C4, C22,

❒	1	47uF, 16V Electrolytic Capacitor, C41
❒	1	2200uF, 25V, Electrolytic Capacitor, C24
❒	5	0.1uF Ceramic Capacitor, C5, C7, C21, C23, C43

DIODES

❒	2	1N4148 Diode (marked 1N4148), CR1, CR41
❒	1	1N4002 Diode (marked 1N4002), CR21
❒	1	1N5819 Diode (marked 1N5819), CR22
❒	2	LED, Blue, D21, D22
❒	1	LED, Red, D2
❒	1	Luxeon LED, D1 (1.5 Kit Only) – NO LONGER AVAILABLE

SEMICONDUCTORS

❒	2	2N4401 Transistor, NPN, Q1, Q3
❒	2	2N4403 Transistor, PNP, Q2, Q41
❒	2	2N2222 Transistor, NPN, Q5, Q6
❒	1	2N2222 Transistor, NPN, Q4 (1.5 Kit Only)

INTEGRATED CIRCUITS (ICs)

❒	1	5V Regulator (marked LM7805 or LM340T-5), U21
❒	1	Microcontroller (marked PIC16F819), U1

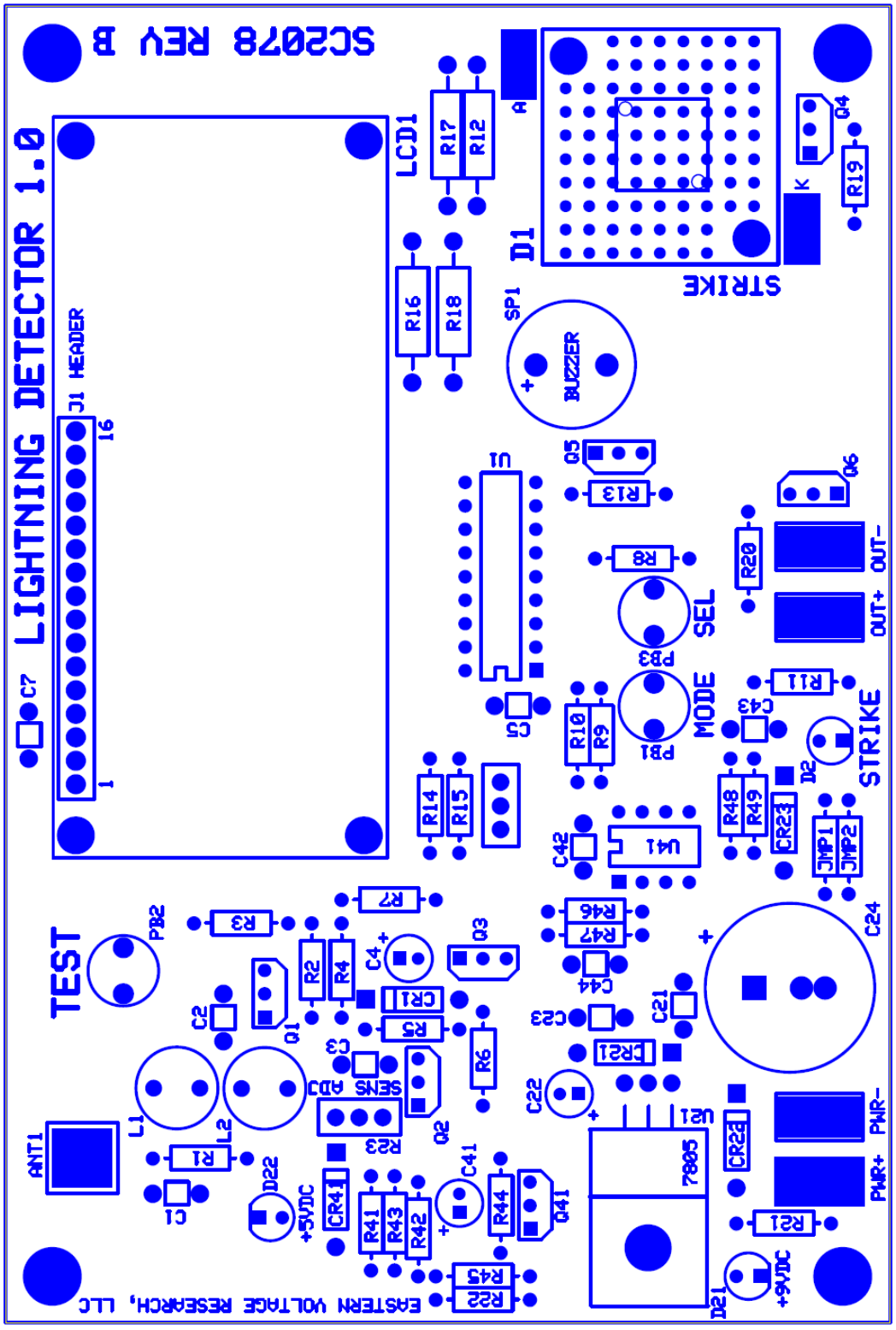
MISCELLANEOUS

❒	1	16x2 LCD Display Module, LCD1
❒	1	18-DIP IC Socket
❒	3	Pushbutton, PB1, PB2, PB3
❒	1	Inductor, 10mH, L1 (new inductors are marked 106KE)
❒	1	Inductor, 1mH, L2 (new inductors are marked 105KE)
❒	1	Antenna (Wire supplied by customer)
❒	1	Piezo Buzzer, SP1
❒	1	9V Wall Adapter Power Supply
❒	1	16-Position Header Strip

- ❒ 4 Stand-offs, 6-32, 0.5” Length
- ❒ 4 Stand-offs, 4-40, 0.25” Length
- ❒ 4 Screws, Panhead, 6-32, 3/16” Length
- ❒ 8 Screws, Panhead, 4-40, 3/16” Length

- ❒ 1 Adhesive Thermal Insulator for High Intensity LED (1.5 Kit Only)

Lightning Detector Component Layout Diagram (Rev B PCB)



KIT Building Instructions

Now we will begin building the kit. There are just a few more important things to know before we install the first components.

For each component, the word "install" always means the following:

1. Pick the correct value to start with.
2. Insert the component into the correct printed circuit board (PCB) location.
3. Orient the component correctly – especially when there is a right and a wrong way to solder it in. (i.e. electrolytic capacitors, diodes, ICs, transistors, etc…)
4. Solder all connections unless directed otherwise. Ensure enough heat is used to allow solder to flow for clean, shiny, and completed connections.

Also, please be sure to take us seriously when we say that good soldering is the key to the proper operation of your circuit!

- Use a 25W soldering pencil with a clean, sharp tip. DO NOT USE a high power soldering gun such as those trigger activated units.
- Use only rosin core solder intended for electronics use
- Ensure your work area is clean, and has plenty of bright lighting
- Build your kit in stages, taking breaks to check your work. Be sure to clean the board periodically with a brush or compressed air to remove any excess wire cuttings, etc…

Okay, so let's begin!

❒ 1. Install R1, 270k resistor (red-violet-yellow)

❒ 2. Install R2, 1Meg resistor (brown-black-green)

❒ 3. Install R3, 270k resistor (red-violet-yellow)

❒ 4. Install R4, 10k resistor (brown-black-orange)

❒ 5. Install R5, 82k resistor (gray-red-orange)

❒ 6. Install R6, 3.9k resistor (orange-white-red)

❒ 7. Install R7, 1k resistor (brown-black-red)

❒ 8. Install R8, 47k resistor (yellow-violet-orange)

❒ 9. Install R9, 47k resistor (yellow-violet-orange)

- ❒ 10. Install R10, 47k resistor (yellow-violet-orange)
- ❒ 11. Install R11, 560 ohm resistor (green-blue-brown)
- ❒ 12. Install R13, 1k resistor (brown-black-red)
- ❒ 13. Install R14, 8.66k, 1% resistor (gray-blue-blue-brown-brown)
- ❒ 14. Install R15, 1.40k, 1% resistor (brown-yellow-black-brown-brown)
- ❒ 15. Install R16, 10 ohm, 1/2W resistor (brown-black-black)
- ❒ 16. Install R18, 10 ohm, 1/2W resistor (brown-black-black)
- ❒ 17. Install R20, 1k resistor (brown-black-red)
- ❒ 18. Install R21, 1.5k resistor (brown-green-red)
- ❒ 19. Install R22, 560 resistor (green-blue-brown)
- ❒ 20. Install R41, 100k resistor (brown-black-yellow)
- ❒ 21. Install R42, 1Meg resistor (brown-black-green)
- ❒ 22. Install R43, 10Meg resistor (brown-black-blue)
- ❒ 23. Install R44, 1k resistor (brown-black-red)
- ❒ 24. Install R45, 1k resistor (brown-black-red)
- ❒ 25. Install R19, 1k resistor (brown-black-red) **(1.5 Kit Only)**
- ❒ 26. Install R17, 16 ohm, 1/2W resistor (brown-blue-black) **(1.5 Kit Only)**
- ❒ 27. Install the zero ohm resistor (single black stripe) in the CR23 location
- ❒ 28. Install CR1, 1N4148 diode. The cathode band on the diode must match that shown on the silkscreen.
- ❒ 29. Install CR41, 1N4148 diode. The cathode band on the diode must match that shown on the silkscreen.
- ❒ 30. Install CR21, 1N4002 diode. The cathode band on the diode must match that shown on the silkscreen.

- ❒ 31. Install CR22, 1N5819 diode. The cathode band on the diode must match that shown on the silkscreen.
- ❒ 32. Install C1, 10pF capacitor (marking 10J)
- ❒ 33. Install C2, 1000pF capacitor (marking BC102 or M39014/01-1317V)
- ❒ 34. Install C3, 100pF capacitor (marking BC101 or M39014/01-1219V)
- ❒ 35. Install C5, 0.1uF capacitor (marking BC104)
- ❒ 36. Install C7, 0.1uF capacitor (marking BC104)
- ❒ 37. Install C21, 0.1uF capacitor (marking BC104)
- ❒ 38. Install C23, 0.1uF capacitor (marking BC104)
- ❒ 39. Install C43, 0.1uF capacitor (marking BC104)
- ❒ 40. Install C4, 10uF, 50V electrolytic capacitor. Install this capacitor into the board ensuring the positive side of the capacitor installs in the hole that is marked positive on the PCB layout.
- ❒ 41. Install C22, 10uF, 50V electrolytic capacitor. Install this capacitor into the board ensuring the positive side of the capacitor installs in the hole that is marked positive on the PCB layout.
- ❒ 42. Install C41, 47uF, 16V electrolytic capacitor. Install this capacitor into the board ensuring the positive side of the capacitor installs in the hole that is marked positive on the PCB layout.
- ❒ 43. Install C24, 2200uF, electrolytic capacitor. C1 has “polarity.” Polarity means the capacitor must be inserted a certain way. You may notice that one side of the capacitor, there is a black stripe with minus signs. This is the negative end. Looking at the PCB silkscreen, you will notice the positive side marked. Install this capacitor into the board ensuring the positive side of the capacitor installs in the hole that is marked positive on the PCB layout.
- ❒ 44. Install pushbutton, PB1
- ❒ 45. Install pushbutton, PB2
- ❒ 46. Install pushbutton, PB3

❒ 47. Install D21, blue LED. The short lead of the diode is the cathode and will install into the square pad on the PCB board.

❒ 48. Install D22, blue LED. The short lead of the diode is the cathode and will install into the square pad on the PCB board.

❒ 49. Install D2, red LED. The short lead of the diode is the cathode and will install into the square pad on the PCB board.

❒ 50. Install buzzer, SP1. SP1 has "polarity." Polarity means the buzzer must be inserted a certain way. You may notice that one side of the buzzer has a "+" sign. This is the positive end. Looking at the PCB silkscreen, you will notice the positive side marked. Install the buzzer into the board ensuring the positive side (marked "+" or with a dot) of the buzzer installs in the hole that is marked positive ("+") on the PCB layout. **Note: If you plan on cleaning your PCB board in an alcohol bath, be sure to leave the white protective sticker over the buzzer until you have cleaned the PCB board otherwise you may damage the buzzer.**

❒ 51. Install L1, 10mH inductor (old marking 103) (new marking 106)

❒ 52. Install L2, 1mH inductor (old marking 102) (new marking 105)

❒ 53. Install the 18-pin DIP socket into the U1 location. Note that one end of the DIP socket is marked by a notch; this end MUST be oriented as shown on the PCB layout. **DO NOT INSTALL U1 at this time.**

❒ 54. Install Q1, 2N4401 transistor (marked 2N4401). This transistor needs to be orientated properly. Please insert Q1 into the board with the flat edge of the transistor orientated according to the silkscreen layout drawing.

❒ 55. Install Q3, 2N4401 transistor (marked 2N4401). This transistor needs to be orientated properly. Please insert Q3 into the board with the flat edge of the transistor orientated according to the silkscreen layout drawing.

❒ 56. Install Q2, 2N4403 transistor (marked 2N4403). This transistor needs to be orientated properly. Please insert Q2 into the board with the flat edge of the transistor orientated according to the silkscreen layout drawing.

❒ 57. Install Q41, 2N4403 transistor (marked 2N4403). This transistor needs to be orientated properly. Please insert Q41 into the board with the flat edge of the transistor orientated according to the silkscreen layout drawing.

❒ 58. Install Q5, MPS2222A transistor (marked 2N2222A, PN2222A, or MPS2222A). This transistor needs to be orientated properly. Please insert Q5

into the board with the flat edge of the transistor orientated according to the silkscreen layout drawing.

❒ 59. Install Q6, MPS2222A transistor (marked 2N2222A, PN2222A, or MPS2222A). This transistor needs to be orientated properly. Please insert Q6 into the board with the flat edge of the transistor orientated according to the silkscreen layout drawing.

❒ 60. Install Q4, MPS2222A transistor (marked 2N2222A, PN2222A, or MPS2222A). This transistor needs to be orientated properly. Please insert Q6 into the board with the flat edge of the transistor orientated according to the silkscreen layout drawing. **(1.5 Kit Only)**

❒ 61. Install U21, LM7805 Linear Regulator. (marked LM7805 or LM340T-5) This component must be installed with the included heatsink and hardware. The easiest way to solder this to the board is to first attach the component and heatsink / hardware to the board, ensuring the leads on U21 are properly bent (formed) to align with the solder holes and heatsink mounting hole. Once the heatsink assembly is attached, the three (3) leads of the LM7805 can be soldered to the PCB. Be sure not to bend the leads more than once as they will break!

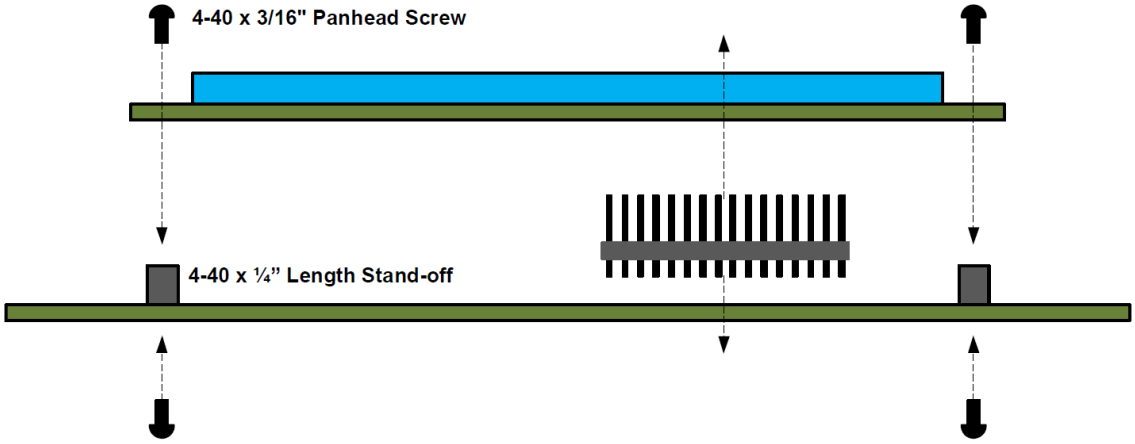
❒ 62. Install the 16-position header into the PCB location marked "J1 Header." One side of the header has short pins while the opposite side has longer pins. The side with the short pins is the side which should be installed into PCB board.

❒ 63. Install R23, 1Meg potentiometer. Polarity is not important when installing the potentiometer.

❒ 64. Install the four (4) ½" length 6-32 stand-offs to the bottom of the board at the four corners of the board using the included 6-32 x 3/16" length panhead screws. These stand-offs act as the mounting feet for the board.

❒ 65. Install the four (4) ¼" length 4-40 stand-offs on the topside of the board at each of the four (4) holes located within the silkscreen outline for LCD1 using the included 4-40 x 3/16" length panhead screws. These will form the supports for which the LCD display will be installed.

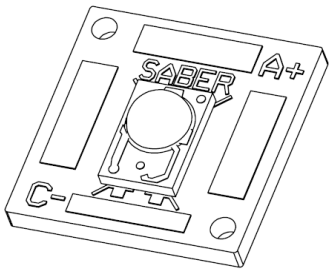
❒ 66. Carefully install the LCD display to the PCB board by aligning both the header strip holes to the header strip on the board and the LCD display mounting holes to the stand-off supports on the PCB board. DO NOT solder the LCD display to the board at this time!



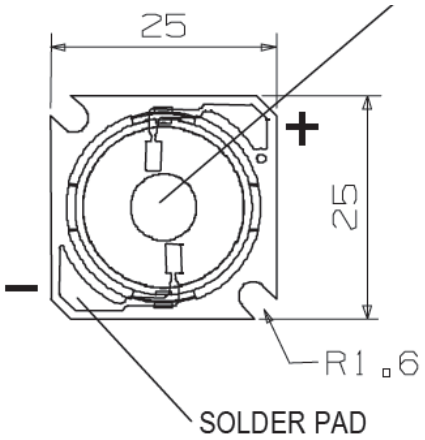
❒ 67. Using the included four (4) 4-40 x 3/16" panhead screws, secure the LCD display to the four (4) support stand-offs on the PCB board. The four mounting holes the LCD display board are slightly smaller than the diameter of the 4-40 panhead screws, so you will have to use a little force when screwing them through the board. This is normal. Just be careful not to damage the traces on the topside of the LCD display board by tightening the mounting screws too tightly.

❒ 68. When the LCD display is properly aligned and secured to the PCB board with the included mounting hardware, solder the header strip to the LCD display board.

❒ 69. Using the included 10mm adhesive backed mounting pad, attach D1, Luxeon High Intensity LED, to the center of the D1 mounting area on the PCB board. The LED should be installed so that the Anode side of the LED is oriented upwards. As shown in the diagram below, the Anode side of the LED is indicated by the A+ marking. **(1.5 Kit Only)**



❒ 70. If you have an older version of the kit, you would have received the older Luxeon STAR-O High Intensity LEDs. These LEDs are mounted via the included 4-40 screws and nuts. They should also be installed so that the Anode side of the LED is oriented upward. As shown in the diagram below, the Anode side of the LED is indicated by the small brass dot which is located next to the Anode solder pad. **(1.5 Kit Only – Legacy Version)**



❒ 71. Using a piece of wire, connect the Anode pad of the LED to the D1 pad marked "A" on the PCB board. **(1.5 Kit Only)**

❒ 72. Using a piece of wire, connect the Cathode pad of the LED to the D1 pad marked "K" on the PCB board. **(1.5 Kit Only)**

❒ 73. This step requires installing a piece of wire for use as the antenna. We recommend using a 12-24" length of wire. The gauge is not important, although you may wish to select a wire type based on rigidity. Likewise, you may also use your own telescoping antenna as well. We originally had a telescoping antenna, but the antenna is no longer available and we found through our testing that a piece of wire provides improvement in performance. Install this wire (solder) to the PCB board in the hole marked ANT1.

❒ 74. The next step is to connect the 9V AC power adapter to the board. First, take the 9V AC power adapter and cut off the end connector if there is any. Strip about a ¼" of insulation on each of the wires. Using a multimeter, determine which wire is positive polarity. Install the positive wire on the pad marked "PWR+" on the PCB board. Install the negative wire on the pad marked "PWR-" on the PCB board.

Congratulations! You have just completed your Lightning Detector kit. Please take a few moments to look over the board and ensure that all the components are installed properly with the correct orientation. Since some of the parts may be unfamiliar to you, you may want to be extra sure that they have been inserted correctly. After you are sure that everything seems to be properly installed, move on to the set-up and testing section.

Set-up and Testing

Okay, so lets begin!

RECOMMENDED TEST EQUIPMENT, NOT SUPPLIED

❒ 1 Analog or Digital Multimeter

U1 (PIC16F819) should not be installed at this time!

❒ 1. Plug in the 9V AC adapter power cord. Note that U1 (PIC16F819) should NOT be installed at this time. Using a multimeter, verify that the following voltages are correct. If they are not, then there is a problem with your circuit that needs to be diagnosed and corrected.

Check	Component	Measuring Point	Voltage
❒	U1	Pin 14 (Positive)	5V ± 0.1V

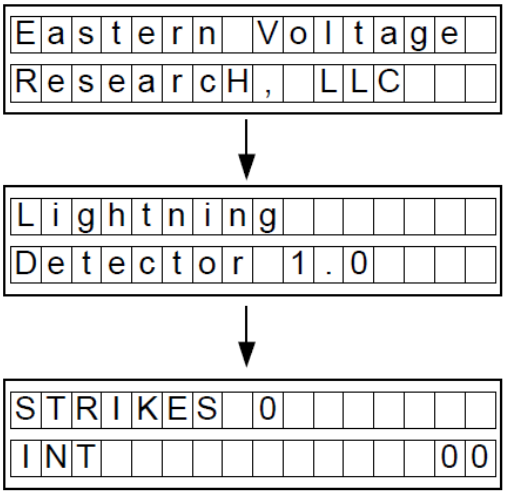
Note: All voltages should be measured with respect to GND which is the "PWR-" terminal of the board.

❒ 2. Verify that both LEDs, D21 and D22, are illuminated. If they are not, and the voltages above are correct, they may be installed backwards.

❒ 3. Unplug the 9V AC power cord.

❒ 4. Install U1, PIC16F819 Microcontroller IC. Note that one end of the IC is marked by a dot, notch, or band; this end MUST be oriented as shown on the PCB layout.

❒ 5. The lightning detector is now ready for initial turn-on. First, double check that U1, PIC16F819, is installed in the correct orientation. Next, plug in the 9V AC power cord. The unit should power-on, initialize with several audible beeps and the onboard STRIKE LEDs should illuminate briefly. The LCD will also display the following introduction screen and finally display the lightning count display screen.



❒ 6. Now what is also likely occurring, is that the lightning detector is falsely counting lightning strikes. This is because the sensitivity potentiometer, R23, is not set properly. Using a small screw driver, turn potentiometer R23 CLOCKWISE until the false triggering stops. Once the false triggering stops, continue the turning potentiometer for at least several more turns until the potentiometer adjustment screw is at its end stop. This can usually felt by a very subtle click when adjusting the potentiometer screw. The sensitivity now should be at its minimum.

❒ 7. Go ahead and push the TEST pushbutton. This manually triggers a lightning strike and you should see the counter increment by one. There will also be an audible beep and the STRIKE LED will illuminate. If you push the TEST pushbutton repetitively very quickly, you'll start seein the INT (Storm Intensity) bar graph start increasing. The INT bargraph relates the frequency of the lightning strikes to a two digit Storm Intensity number ranging from 00 to 99. This number and scaling is completely arbitrary, but does provide a relative number for comparison on the intensity of a lightning storm. The gain (sensitivity) of this Storm Intensity circuit can be changed by the user and will be discussed later in this document.

Congratulations! Your Lightning Detector is now completed and operational. The next section will document how to set-up and properly use the Lightning Detector.

Locating the Lightning Detector

Locating the Lightning Detector is very important. For best operation, locate the Lightning Detector near a window and away from walls and other enclosed spaces. Even though your house is made of wood, it still provides attenuation of the electromagnetic energy that a lightning strike creates. So obviously, if you place this in your basement away from windows and doors, it won't be as sensitive as if it was placed next to a window.

Adjusting the Sensitivity of the Lightning Detector

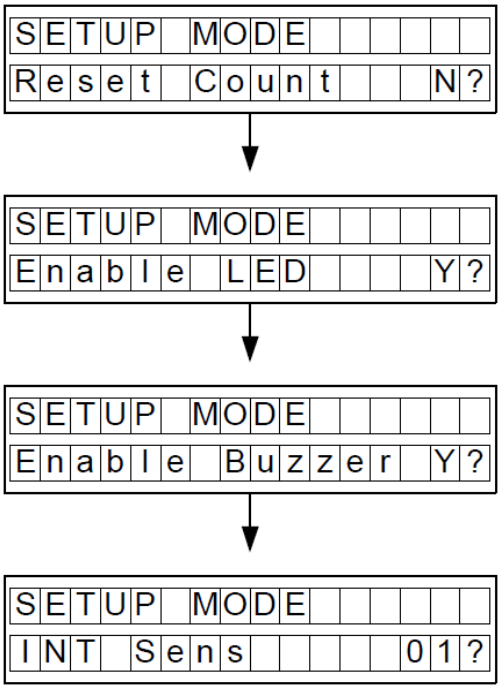
Adjusting the sensitivity of the lightning detector can be accomplished several ways. The first way to adjust the sensitivity is through the length of the antenna. By varying the height of the antenna, you can increase (raising antenna), or decrease (lowering antenna) the sensitivity. Typically, the antenna will always be a full height. Potentiometer, R23, can also be used to adjust the sensitivity of the antenna. By turning R23 counter-clockwise, you will begin increasing the sensitivity of the lightning detection circuit. Continue turning until the unit starts false triggering. Then back off a turn or two. This should be a good setpoint. However, as you increase sensitivity, you also increase the probability of false triggering. False triggering can occur by merely touching the board, or turning a nearby lighting switch ON. If you find the unit is being falsely triggered quite a bit, then reduce sensitivity by turning R23 clockwise a turn or two.

Increasing Range of the Lightning Detector

Using a long wired antenna can be used to significantly increase the range (miles) of lightning detection. A 20 foot length of antenna wire routed through the attic of your house and then soldered to the ANT1 location on the PCB board will provide greater range of detection. However, it will also be prone to more false triggering. This can be reduced by adjusting potentiometer, R23.

Set-up Mode

The Lightning Detector features a set-up mode than can be accessed by the user to change several of the internal settings. This mode can be accessed by pressing and holding the MODE pushbutton for about 2-3 seconds. The following diagram shows the various set-up screens available in set-up mode.



RESET COUNT

The first screen you will see upon entering set-up mode is the Reset Count screen. This allows the user to reset the lightning strike count without powering down the lightning detector. Pressing the SEL pushbutton toggles between Y (yes) and N (no). Press the MODE pushbutton to accept the selection and move to the next set-up screen.

ENABLE LED

The next screen is the Enable LED screen. This allows the user to enable or disable the LED illumination when a lightning strike is detected. Pressing the SEL pushbutton toggles between Y (yes) and N (no). Press the MODE pushbutton to accept the selection and move to the next set-up screen. Also it is important to note that the high current external output is shared by the LED output control. So if you disable the LED, you will also disable this high current external output.

ENABLE BUZZER

The next screen is the Enable Buzzer screen. This allows the user to enable or disable the audible buzzer sound when a lightning strike is detected. Pressing the SEL pushbutton toggles between Y (yes) and N (no). Press the MODE pushbutton to accept the selection and move to the next set-up screen.

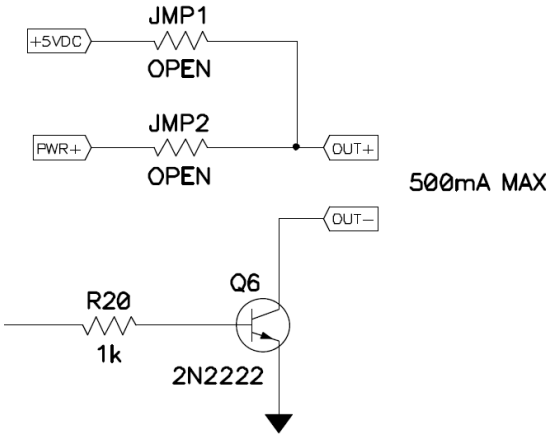
STORM INTENSITY Sensitivity

The next screen is the Storm Intensity bargraph sensitivity screen. As lightning strikes increase in frequency (strikes per minute), the INT bar graph will begin to read higher and higher numbers thereby giving a relative level of storm intensity. The user can adjust this sensitivity by varying the gain number provided here. The default setting is "1." The higher the number, the higher the INT sensitivity. The allowable sensitivity range is from 01 to 20. Once this number is set, the user can test the INT bargraph by pressing the TEST pushbutton to simulate lightning strikes and get a reading of the INT bargraph manually. Pressing the SEL pushbutton will increment the sensitivity number by one. Press the MODE pushbutton to accept the selection and exit set-up mode.

Finally, when you make changes to the settings in set-up mode, they are stored in an internal memory (EEPROM) location which will retain the settings even when the lightning detector is powered down.

External Transistor Output

The Lightning Detector also features a high current open collector transistor output for controlling relays or other external electronic devices. The open collector output is turned ON when a lightning strike is detected and the Enable LED function is enabled in the Set-up Menu.



The maximum current capability of this output is approximately 500mA. The voltage of OUT+ can be set to either +5VDC (JMP1 shorted) or +9VDC (JMP2 shorted). If driving a relay, it is strongly recommended to place a rectifier diode (i.e. 1N4001) across the relay coil to protect the coil from voltage spikes when Q6 turns off. The diode should be

placed across the relay coil contacts so that the cathode end of the diode is connected to OUT+ side of the relay coil.

Troubleshooting

PROBLEM: Blue LEDs not illuminated
SOLUTION: This is typically due to the polarity of the 9V AC adapter power supply being incorrect. Re-verify the polarity of the 9V AC adapter power supply wires with a multimeter and reconnect to the lightning detector board.

PROBLEM: No initialization beeps or LCD display (Blue LEDs are illuminated)
SOLUTION: U1 may be installed incorrectly. Please power down the lightning detector and check that U1 is installed in the correct orientation.

PROBLEM: The unit is continually false triggering.
SOLUTION: Sensitivity potentiometer, R23, is set improperly. Using a small screw driver, decrease the sensitivity of the lightning detection circuit by turning the R23 setscrew in the clockwise direction.

Conclusion

We sincerely hope that you have enjoyed the construction of this Eastern Voltage Research Kit. As always, we have tried to write this instruction manual in the easiest, most "user friendly" format that is possible. As our customers, we value your opinions, comments, and additions that you would like to see in future publications. Please submit comments or ideas to:

Eastern Voltage Research, LLC

Technical Support
support@easternvoltageresearch.com

Thanks again from the people here at Eastern Voltage Research.

Terms and Conditions of Sale

Before opening or assembling your kit, please read and review the latest Terms and Conditions of Sale on our website at the following link:

http://www.easternvoltageresearch.com/terms.html

Military Dash Number Identification (M39014/01-xxxx) – Ceramic Capacitors

Failure Rate Level (%/1,000 Hours)				Capacitance (pF)	Capacitance Tolerance ±Percent	WVDC
1.0 (M)	0.1 (P)	0.01 (R)	0.001 (S)			
CKR05 (BX)						
1201	1241	1281	1321	10	10	200
1202	1242	1282	1322	10	20	200
1203	1243	1283	1323	12	10	200
1204	1244	1284	1324	15	10	200
1205	1245	1285	1325	15	20	200
1206	1246	1286	1326	18	10	200
1207	1247	1287	1327	22	10	200
1208	1248	1288	1328	22	20	200
1209	1249	1289	1329	27	10	200
1210	1250	1290	1330	33	10	200
1211	1251	1291	1331	33	20	200
1212	1252	1292	1332	39	10	200
1213	1253	1293	1333	47	10	200
1214	1254	1294	1334	47	20	200
1215	1255	1295	1335	56	10	200
1216	1256	1296	1336	68	10	200
1217	1257	1297	1337	68	20	200
1218	1258	1298	1338	82	10	200
1219	1259	1299	1339	100	10	200
1220	1260	1300	1340	100	20	200
1221	1261	1301	1341	120	10	200
1222	1262	1302	1342	150	10	200
1223	1263	1303	1343	150	20	200
1224	1264	1304	1344	180	10	200
1225	1265	1305	1345	220	10	200
1226	1266	1306	1346	220	20	200
1227	1267	1307	1347	270	10	200
1228	1268	1308	1348	330	10	200
1229	1269	1309	1349	330	20	200
1230	1270	1310	1350	390	10	200
1231	1271	1311	1351	470	10	200
1232	1272	1312	1352	470	20	200
1233	1273	1313	1353	560	10	200
1234	1274	1314	1354	680	10	200
1235	1275	1315	1355	680	20	200
1236	1276	1316	1356	820	10	200
1237	1277	1317	1357	1,000	10	200
1238	1278	1318	1358	1,000	20	200
1239	1279	1319	1359	1,200	10	100
1240	1280	1320	1360	1,500	10	100
1441	1481	1521	1561	1,500	20	100
1442	1482	1522	1562	1,800	10	100
1443	1483	1523	1563	2,200	10	100
1444	1484	1524	1564	2,200	20	100
1445	1485	1525	1565	2,700	10	100
1446	1486	1526	1566	3,300	10	100
1447	1487	1527	1567	3,300	20	100
1448	1488	1528	1568	3,900	10	100
1449	1489	1529	1569	4,700	10	100
1450	1490	1530	1570	4,700	20	100
1451	1491	1531	1571	5,600	10	100
1452	1492	1532	1572	6,800	10	100
1453	1493	1533	1573	6,800	20	100
1454	1494	1534	1574	8,200	10	100
1455	1495	1535	1575	10,000	10	100
1456	1496	1536	1576	10,000	20	100
1457	1497	1537	1577	12,000	10	50
1458	1498	1538	1578	15,000	10	50
1459	1499	1539	1579	15,000	20	50
1460	1500	1540	1580	18,000	10	50
1461	1501	1541	1581	22,000	10	50
1462	1502	1542	1582	22,000	20	50
1463	1503	1543	1583	27,000	10	50
1464	1504	1544	1584	33,000	10	50
1465	1505	1545	1585	33,000	20	50
1466	1506	1546	1586	39,000	10	50
1467	1507	1547	1587	47,000	10	50
1468	1508	1548	1588	47,000	20	50
1469	1509	1549	1589	56,000	10	50
1470	1510	1550	1590	68,000	10	50
1471	1511	1551	1591	68,000	20	50
1472	1512	1552	1592	82,000	10	50
1473	1513	1553	1593	100,000	10	50
1474	1514	1554	1594	100,000	20	50

Military Dash Number Identification (M39014/02-xxxx) – Ceramic Capacitors

Failure Rate Level (%/1,000 Hours)				Capacitance (pF)	Capacitance Tolerance ±Percent	WVDC
1.0 (M)	0.1 (P)	0.01 (R)	0.001 (S)			
CKR06 (BX)						
1201	1241	1281	1321	1200	10	200
1202	1242	1282	1322	1500	10	200
1203	1243	1283	1323	1500	20	200
1204	1244	1284	1324	1800	10	200
1206	1246	1286	1326	2200	10	200
1207	1247	1287	1327	2200	20	200
1208	1248	1288	1328	2700	10	200
1209	1249	1289	1329	3300	10	200
1210	1250	1290	1330	3300	20	200
1211	1251	1291	1331	3900	10	200
1212	1252	1292	1332	4700	10	200
1213	1253	1293	1333	4700	20	200
1214	1254	1294	1334	5600	10	200
1215	1255	1295	1335	6800	10	200
1216	1256	1296	1336	6800	20	200
1217	1257	1297	1337	8200	10	200
1218	1258	1298	1338	10,000	10	200
1219	1259	1299	1339	10,000	20	200
1231	1271	1311	1351	12,000	10	100
1220	1260	1300	1340	15,000	10	100
1221	1261	1301	1341	18,000	10	100
1222	1262	1302	1342	22,000	10	100
1232	1272	1312	1352	27,000	10	100
1223	1263	1303	1343	33,000	10	100
1224	1264	1304	1344	39,000	10	100
1225	1265	1305	1345	47,000	10	100
1226	1266	1306	1346	56,000	10	100
1227	1267	1307	1347	68,000	10	100
1229	1269	1309	1349	82,000	10	100
1230	1270	1310	1350	100,000	10	100
1233	1273	1313	1353	120,000	10	50
1234	1274	1314	1354	150,000	10	50
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1404	1408	1412	1416	560,000	10	50
1405	1409	1413	1417	680,000	10	50
1406	1410	1414	1418	820,000	10	50
1407	1411	1415	1419	1,000,000	10	50