

Introduction and DISCLAIMER

NOTE: Eastern Voltage Research reserves the right to modify, add, or remove components offered in the kit at any time and without notice to the customer. Parts may be changed and/or removed and inclusion of a part in this instruction manual does not imply in any way that the part is part of the purchased kit. If there is a question about a part not included in the kit that is listed here, please contact Eastern Voltage Research for further clarification and assistance.



This kit is designed and sold for hobby and novelty use only. It is not designed, nor should be used for personal protection, equipment protection, or scientific or commercial use.

Introduction to the Lightning Detector 2.0 and Circuit Description

The Lightning Detector 2.0 is a 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...

The subcircuit comprised of Q2 and Q3 simply produces a one-shot pulse which is sent to the 555 timer which acts as a one-shot pulse to illuminate the four (4) detect LEDs for a short duration of time. The length of the LED detect duration can be varied by changing the value of C5. U2 is a simple 5V linear regulator circuit which converts the incoming 7-12V to 5VDC. Finally, TB2 is an external output that can be used to drive external devices. Note, the output of TB2 is active low meaning that when there is no lightning strike, the output is pulled-up to 5VDC. When lightning is detected, this output will be driven low.

Lightning Detector 2.0 Parts List

Resistors

- 2 270k Resistor (red-violet-yellow), R1, R4
- 2 10k Resistor (brown-black-orange), R2, R8
- 1 1Meg Resistor (brown-black-green), R3
- 1 82k Resistor (gray-red-orange), R5
- 1 3.9k Resistor (orange-white-red), R6
- 1 1k Resistor (brown-black-red), R7
- 5 560 ohm Resistor (green-blue-brown), R9, R10, R11, R12, R13

Capacitors

- 1 10pF Capacitor, Ceramic, C1
- 1 1000pF Capacitor, Ceramic, C2
- 1 100pF or 120pF Capacitor, Ceramic, C3
- 1 10uF, 50V Capacitor, Electrolytic, C4
- 1 1uF Capacitor, Ceramic, C5
- 2 0.1uF Capacitor, Ceramic, C6, C8
- 1 0.33uF Capacitor, Ceramic, C7
- 1 1000uF, 16V Capacitor, Electrolytic, C9

Diodes

- 1 1N4148 Diode (marked 1N4148), CR1
- 4 LED, Red, High-Brightness, D1, D2, D3, D4
- 1 LED, Blue, D5

Semiconductors

- 2 2N4401 Transistor, NPN, Q1, Q3
- 1 2N4403 Transistor, PNP, Q2

Integrated Circuits

- 1 555 Timer IC, U1
- 1 MC78L05AB, Voltage Regulator, 5V, U2

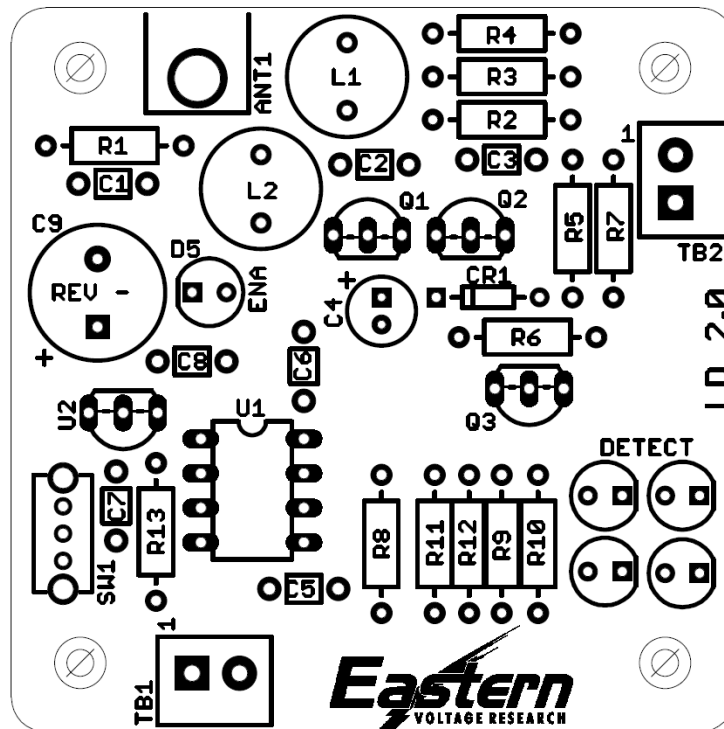
Miscellaneous

- 1 Inductor, 10mH (marked 106KE), L1

- 1 Inductor, 1mH (marked 105KE), L2
- 1 Antenna, Telescoping (optional)
- 1 Screw, Panhead, 4-40, 1/4" Length
- 1 Nut, 4-40, Nylon Locking
- 4 Screws, Panhead, 6-32, 3/16" Length
- 4 Stand-offs, 6-32, 3/8" Length
- 2 Terminal Block, 2-Position, TB1, TB2
- 1 Switch, SW1
- 1 8-DIP Socket, U1
- 1 PCB, Lightning Detector 2.0 Board

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Lightning Detector Component Layout Diagram



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, 10k resistor (brown-black-orange)
3. Install R3, 1Meg resistor (brown-black-green)
4. Install R4, 270k resistor (red-violet-yellow)
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, 10k resistor (brown-black-orange)
- 9. Install R9, 560 ohm resistor (green-blue-brown)
- 10. Install R10, 560 ohm resistor (green-blue-brown)
- 11. Install R11, 560 ohm resistor (green-blue-brown)
- 12. Install R12, 560 ohm resistor (green-blue-brown)
- 13. Install R13, 560 ohm resistor (green-blue-brown)
- 14. Install CR1, 1N4148 diode. The cathode band on the diode must match that shown on the silkscreen.
- 15. Install C1, 10pF capacitor (marking 10J)
- 16. Install C2, 1000pF capacitor (marking BC102)
- 17. Install C3, 100pF or 120pF capacitor (marking BC101 or BC121)
- 18. 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.
- 19. Install C5, 1uF capacitor (marking BC105)
- 20. Install C6, 0.1uF capacitor (marking BC104)
- 21. Install C7, 0.33uF capacitor (marking BC334)
- 22. Install C8, 0.1uF capacitor (marking BC104)
- 23. Install C9, 1000uF, 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.
- 24. Install D1, red LED. The short lead of the diode is the cathode and will install into the square pad on the PCB board.

- 25. Install D2, red LED. The short lead of the diode is the cathode and will install into the square pad on the PCB board.
- 26. Install D3, red LED. The short lead of the diode is the cathode and will install into the square pad on the PCB board.
- 27. Install D4, red LED. The short lead of the diode is the cathode and will install into the square pad on the PCB board.
- 28. Install D5, blue LED. The short lead of the diode is the cathode and will install into the square pad on the PCB board.
- 29. Install L1, 10mH inductor (marking 106)
- 30. Install L2, 1mH inductor (marking 106)
- 31. Install the 8-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.
- 32. 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.
- 33. Install Q2, 2N4403 transistor (marked 2N4403). 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.
- 34. 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.
- 35. Install U2, MC78L05AB voltage regulator (marked MC78L05AB). This 3-pin voltage regulator needs to be orientated properly. Please insert U2 into the board with the flat edge of the transistor orientated according to the silkscreen layout drawing.
- 36. Install the switch, SW1
- 37. Install the terminal block, TB1. Ensure the openings of the terminal block face outwards.

- 38. Install the terminal block, TB2. Ensure the opening of the terminal block face outwards.
- 39. Install the four (4) 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.
- 40. Attach the antenna to the ANT1 location on the PCB. Use the included 4-40 panhead screw and 4-40 nylon locking nut to secure in place.

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.

Testing and Operation

- 1. Connect a 7.5V to 12.0V power source to TB1. Turn the power switch into the ON position.
- 2. Using a multimeter, verify the voltage across C8 is 5.0V.
- 3. Verify the ENA LED is illuminated.
- 4. You can simulate a lightning strike by touching the antenna with a metal object.
- 5. When a storm is approaching, extend the antenna, and place near a window. When a lightning strike is detected, all four (4) red LEDs should illuminate.
- 6. If you wish to extend the ON time of the duration of the strike LEDs, you can increase the size of R8 or C5. Refer to the 555 timer datasheet for calculating the duration.