LOGIC PROBE KIT

MODEL LP-535K

Instruction & Assembly Manual

Elenco Electronics, Inc.

Revised 2002 REV-A 753272

PARTS LIST

If you are a student, and any parts are missing or damaged, please see instructor or bookstore.
If you purchased this kit from a distributor, catalog, etc., please contact Elenco Electronics (address/phone/e-mail is at the back of this manual) for additional assistance, if needed. **DO NOT** contact your place of purchase as they will not be able to help you.

RESISTORS

Qty.	Symbol	Description	Color Code	Part #
☐ 1	R4	470Ω 1/4W 5%	yellow-violet-brown-gold	134700
☐ 4	R5, R6, R7, R9	1kΩ 1/4W 5%	brown-black-red-gold	141000
☐ 2	R1, R11	20kΩ 1/4W 5%	red-black-orange-gold	152000
☐ 1	R10	33kΩ 1/4W 5%	orange-orange-orange-gold	153300
☐ 1	R3	560kΩ 1/4W 5%	green-blue-yellow-gold	165600
☐ 1	R2	1MΩ 1/4W 5%	brown-black-green-gold	171000
☐ 1	R8	15MΩ 1/4W 5%	brown-green-blue-gold	181500

CAPACITORS

Qty.	Symbol	Value	Description	Part #
☐ 1	C1	68pF	Discap (68)	216816
☐ 1	C2	220pF	Discap (220)	222210
☐ 2	C3, C4	.001µF	Discap (102)	231036
☐ 1	C6	.01µF	Discap (103)	241031
☐ 1	C7	.1µF	Discap (104)	251010
☐ 1	C5	.47µF 50V	Electrolytic (Lytic)	254747
☐ 1	C8	47µF 10V	Electrolytic (Lytic)	274742
☐ 1	C9	47µF 50V	Electrolytic (Lytic)	274747

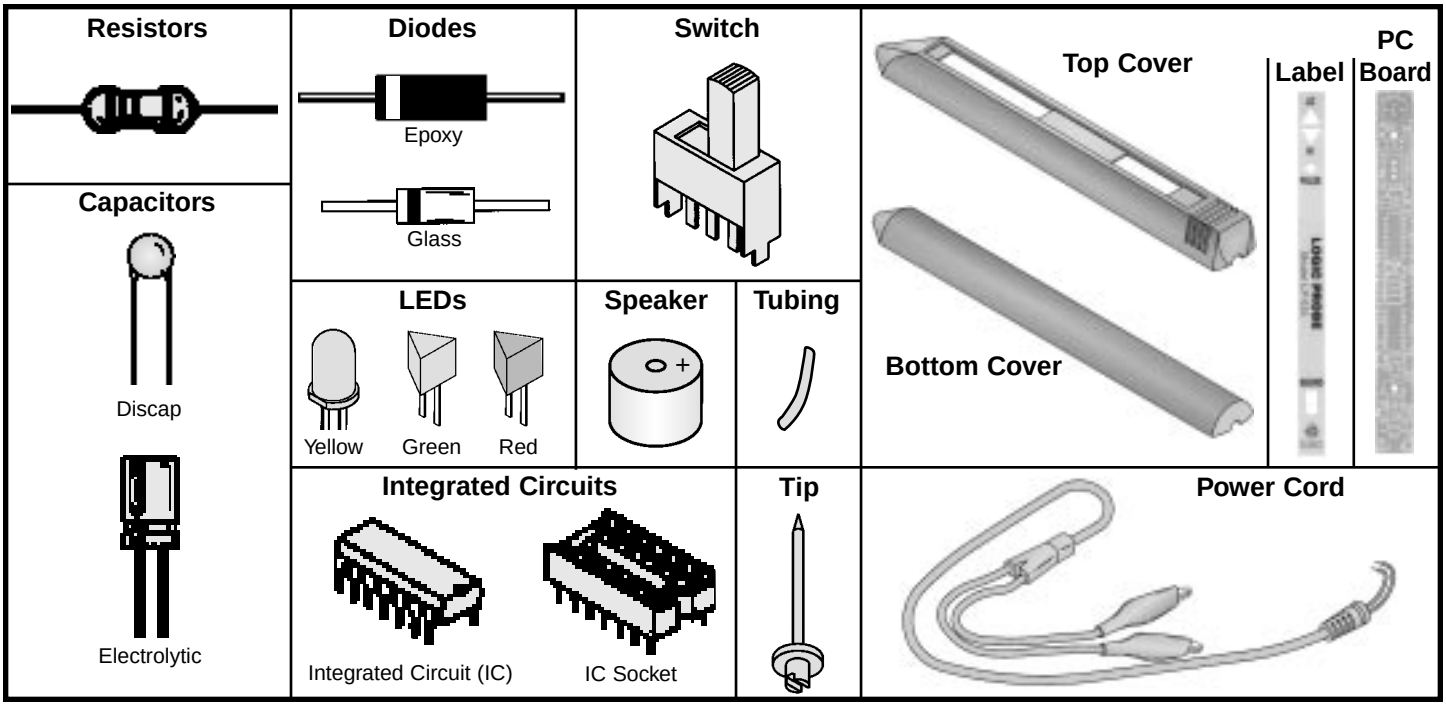
SEMICONDUCTORS

Qty.	Symbol	Value	Description	Part #
☐ 2	D8, D10	1N4001	Diode (epoxy)	314001
☐ 4	D2, D3, D4, D9	1N4148	Diode (glass)	314148
☐ 1	D1	1N5232	Zener Diode 5.6V (bag with capacitors)	315232
☐ 1	D5	L-323 GD	LED Green Triangular	35323G
☐ 1	D6	L-323 ID	LED Red Triangular	35323I
☐ 1	D7	L-934 YDT	LED Yellow	359344
☐ 1	U2	3086	Integrated Circuit	333086
☐ 1	U1	74HC14	Integrated Circuit	39HC14

MISCELLANEOUS

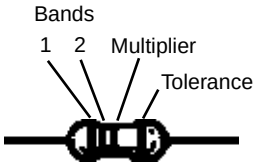
Qty.	Symbol	Description	Part #
☐ 1		PC Board	517030
☐ 1	SP1	Speaker 40Ω	521602
☐ 1	S1	Switch Slide SPDT	541025
☐ 1		Logic Probe Tip	616000
☐ 1		Case (two parts)	623019
☐ 2	U1, U2	Socket IC 14-pin	664014
☐ 1		Label	724009
☐ 1		Manual	753272
☐ 1		Cord Power	863080
☐ 4”		Tubing #20	890020
☐ 0.6”		Shrink Tubing Red 3/32”	891020
☐ 1		Solder Tube	9ST4

PARTS IDENTIFICATION



IDENTIFYING RESISTOR VALUES

Use the following information as a guide in properly identifying the value of resistors.



BAND 1 1st Digit	
Color	Digit
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

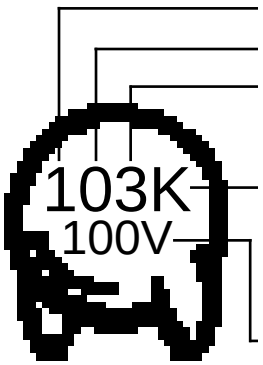
BAND 2 2nd Digit	
Color	Digit
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

Multiplier	
Color	Multiplier
Black	1
Brown	10
Red	100
Orange	1,000
Yellow	10,000
Green	100,000
Blue	1,000,000
Silver	0.01
Gold	0.1

Resistance Tolerance	
Color	Tolerance
Silver	±10%
Gold	±5%
Brown	±1%
Red	±2%
Orange	±3%
Green	±.5%
Blue	±.25%
Violet	±.1%

IDENTIFYING CAPACITOR VALUES

Capacitors will be identified by their capacitance value in pF (picofarads), nF (nanofarads), or µF (microfarads). Most capacitors will have their actual value printed on them. Some capacitors may have their value printed in the following manner.



Multiplier	For the No.	0	1	2	3	4	5	8	9
	Multiply By	1	10	100	1k	10k	100k	.01	0.1

The value is 10 x 1,000 = 10,000pF or .01µF 100V

The letter M indicates a tolerance of ±20%

The letter K indicates a tolerance of ±10%

The letter J indicates a tolerance of ±5%

Note: *The letter "R" may be used at times to signify a decimal point; as in 3R3 = 3.3*

CIRCUIT DESCRIPTION

The Elenco Model LP-535 Logic Probe Kit is a convenient and precise instrument for use in the measurement of logic circuits. It displays logic levels (high or low), sounds high level, and voltage transients down to 10 nanoseconds. To detect the high and low logic levels, the LP-535 uses two inverters, U1A and U1B (see the Schematic Diagram). One inverter drives the LO (green) LED and the other, the HI (red) LED.

The red LED lights when the input voltage is more than 50% of the supply voltage. The function of the switch for TTL or CMOS levels input signal makes up the special circuit on the base of transistors from U2 and additional components. The outputs of U1A and U1B are connected to differential circuits C3/R3 and C4/R7. These differential circuits select signals, when the test signals are the pulses. After the differential circuits, the short pulses go through inverters U1C and U1D to the yellow LED. This LED blinks when the detecting diode D4 opens. At this time, capacitor C6 discharges. The lit time of the yellow LED depends upon the value of C6. The LP-535 is equipped with a sound circuit. When the input signal is HI, the oscillator (U1E, U1F) is started and the frequency through switch S1 passes to the speaker.

SPECIFICATIONS

The LP-535 Logic Probe Kit tests different types of digital logic circuit families.

Working Voltage	4 - 16VDC
Current Consumption	Max 5mA @ 5V Max 15mA @ 15V
Frequency Response	Over 50MHz
Minimum Detectable Pulse Width	10nsec
Input Impedance	1MΩ
Input Overload Protection	70V AC/DC (10s)
Supply Voltage Protection	50V AC/DC (10s)
Operation Temperature	0°C to 50°C
Switch	Selectable Audio Indicator HI Level

Interpreting the LEDs

- ● LED On
- ○ LED Off
- * LED Blinking
- No Sound
- Sound

This information for switch to the sound position.

INPUT SIGNAL	LED STATES LO	HIGH	PULSE	SOUND	
	○	○	○		Probe not connected to power.
	●	○	○		Logic tip is not connected or Logic “0” no pulse activity.
	○	●	○		Logic “1” no pulse activity.
	●	○	*		Logic “0” with positive single pulses.
	○	●	*		Logic “1” with negative single pulses.
	●	○	●		Logic “0” with positive continuous pulses.
	○	●	●		Logic “1” with negative continuous pulses.

CONSTRUCTION

Introduction

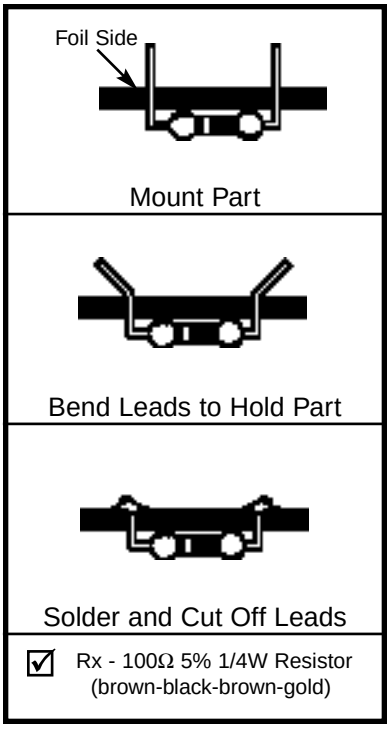
Assembly of your LP-535 Logic Probe Kit will prove to be an exciting project and give you much satisfaction and personal achievement. If you have experience in soldering and wiring techniques, then you should have no problem with the assembly of this kit. Care must be given to identifying the proper components and in good soldering habits. Above all, take your time and follow these easy step-by-step instructions. Remember, "An ounce of prevention is worth a pound of cure". Avoid making mistakes and no problems will occur.

Safety Procedures

- Wear eye protection when soldering.
- Locate soldering iron in an area where you do not have to go around it or reach over it.
- Do not hold solder in your mouth. Solder contains lead and is a toxic substance. Wash your hands thoroughly after handling solder.
- Be sure that there is adequate ventilation present.

Assemble Components

In all of the following assembly steps, the components must be installed on the top side of the PC board unless otherwise indicated. The top legend shows where each component goes. The leads pass through the corresponding holes and the board is turned to solder the component leads on the foil side. Solder immediately unless the pad is adjacent to another hole which will interfere with the placement of the other component. Cut excessive leads with a diagonal cutter. Then, place a check mark in the box provided next to each step to indicate that the step is completed. Be sure to save the extra leads for use as jumper wires if needed.



Soldering

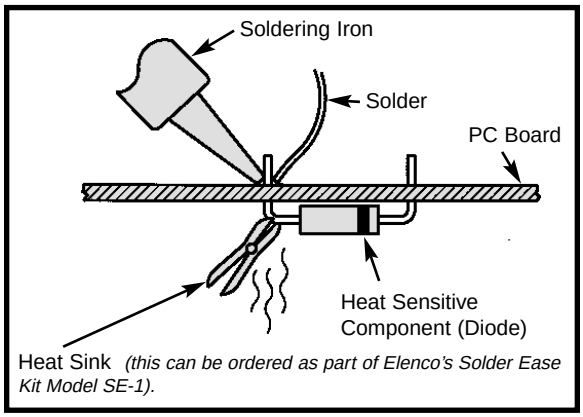
The most important factor in assembling your logic probe kit is good soldering techniques. Using the proper soldering iron is of prime importance. A small pencil type soldering iron of 25 - 40 watts is recommended. **The tip of the iron must be kept clean at all times and well tinned.** Many areas on the PC board are close together and care must be given not to form solder shorts. Size and care of the tip will eliminate problems.

For a good soldering job, the areas being soldered must be heated sufficiently so that the solder flows freely. Apply the solder simultaneously to the component lead and the component pad on the PC board so that good solder flow will occur. Be sure that the lead extends through the solder smoothly indicating a good solder joint. **Use only rosin core solder of 63/37 or 60/40 alloy.**

DO NOT USE ACID CORE SOLDER! Do not blob the solder over the lead because this can result in a cold solder joint.

Heat Sinking

Electronic components such as transistors, IC's, and diodes can be damaged by the heat during soldering. Heat sinking is a way of reducing the heat on the components while soldering. Dissipating the heat can be achieved by using long nose pliers, an alligator clip, or a special heat dissipating clip. The heat sink should be held on the component lead between the part and the solder joint.



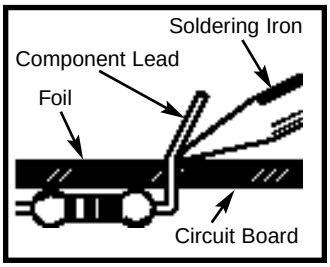
A poorly soldered joint can greatly affect small current flow in circuits and can cause equipment failure. You can damage a PC board or a component with too much heat or cause a cold solder joint with insufficient heat. Sloppy soldering can cause bridges between two adjacent foils preventing the circuit from functioning.

What Good Soldering Looks Like

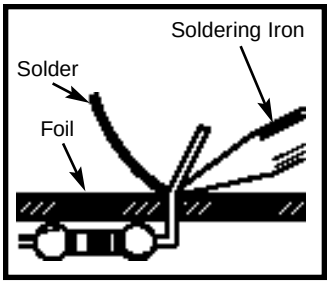
A good solder connection should be bright, shiny, smooth, and uniformly flowed over all surfaces.

Soldering a PC board

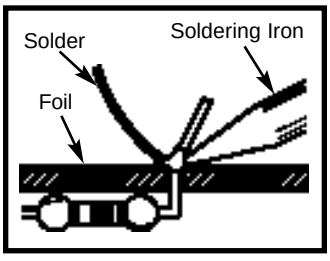
1. Solder all components from the copper foil side only. Push the soldering iron tip against both the lead and the circuit board foil.



2. Apply a small amount of solder to the iron tip. This allows the heat to leave the iron and onto the foil. Immediately apply solder to the opposite side of the connection, away from the iron. Allow the heated component and the circuit foil to melt the solder.



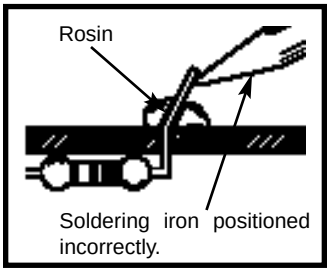
3. Allow the solder to flow around the connection. Then, remove the solder and the iron and let the connection cool. The solder should have flowed smoothly and not lump around the wire lead.



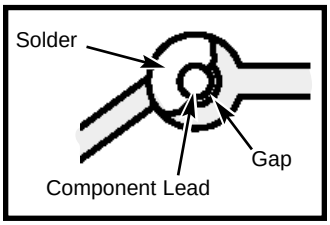
4. Here is what a good solder connection looks like.

Types of Poor Soldering Connections

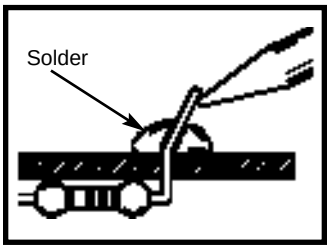
1. **Insufficient heat** - the solder will not flow onto the lead as shown.



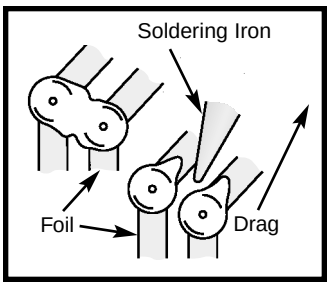
2. **Insufficient solder** - let the solder flow over the connection until it is covered. Use just enough solder to cover the connection.



3. **Excessive solder** - could make connections that you did not intend to between adjacent foil areas or terminals.



4. **Solder bridges** - occur when solder runs between circuit paths and creates a short circuit. This is usually caused by using too much solder. To correct this, simply drag your soldering iron across the solder bridge as shown.



ASSEMBLE COMPONENTS TO THE PC BOARD

* Resistors R2, R4, R6, R7 and R9 are to be installed the standard way as shown on page 4.

☐ SP1 - Speaker
(see Figure A)

☐ D8 - 1N4001 Diode (epoxy)
(see Figure B, vertical)

☐ C9 - 47µF 50V Electrolytic Cap.
(see Figure C)

☐ S1 - Switch Slide
(Solder and cut off excess leads.)

☐ R11 - 20kΩ 5% 1/4W Resistor
(red-black-orange-gold)
(see Figure D)

☐ D10 - 1N4001 Diode (epoxy)
(see Figure B, standard)

☐ C8 - 47µF 10V Electrolytic Cap.
(see Figure C)

☐ U2 - 14-pin IC Socket
☐ U2 - 3086 Integrated Circuit
(see Figure E)

☐ R8 - 15MΩ 5% 1/4W Resistor
(brown-green-blue-gold)
(see Figure D)

☐ R6 - 1kΩ 5% 1/4W Resistor *
(brown-black-red-gold)

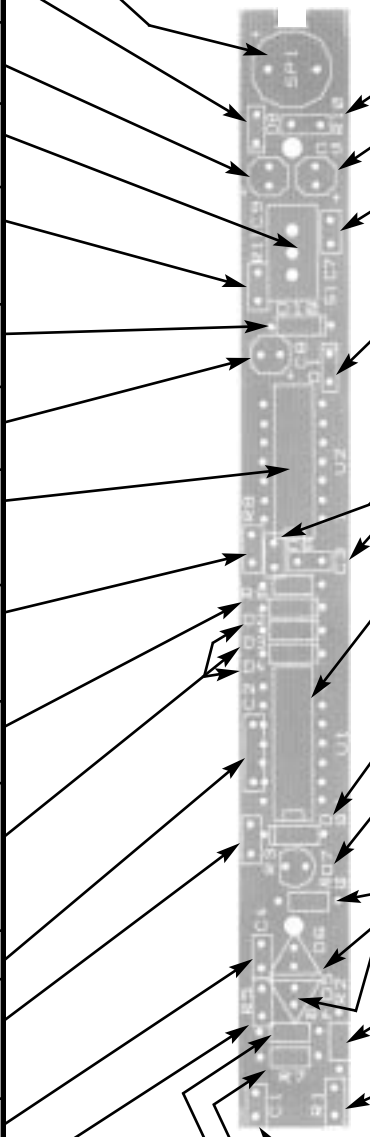
☐ D2 - 1N4148 Diode (glass)
☐ D3 - 1N4148 Diode (glass)
☐ D4 - 1N4148 Diode (glass)
(see Figure B, standard)

☐ C2 - 220pF (220) Discap

☐ R3 - 560kΩ 5% 1/4W Resistor
(green-blue-yellow-gold)
(see Figure D)

☐ C4 - .001µF (102) Discap

☐ R5 - 1kΩ 5% 1/4W Resistor
(brown-black-red-gold)
(see Figure D)



☐ R10 - 33kΩ 5% 1/4W Resistor
(orange-orange-orange-gold)
(see Figure D)

☐ C5 - .47µF 50V Electrolytic Cap.
(see Figure C)

☐ C7 - .1µF (104) Discap

☐ D1 - 1N5232 5.6V Zener Diode
(bag with capacitors) vertical
(see Figure B)

☐ C6 - .01µF (103) Discap

☐ C3 - .001µF (102) Discap

☐ U1 - 14-pin IC Socket
☐ U1 - 74HC14 Integrated Circuit
(see Figure E)

☐ D9 - 1N4148 Diode (glass)
(see Figure B, standard)

☐ D7 - Yellow LED
☐ 7/16" x 2 Tubing #20 (black)
(see Figure F)

☐ R9 - 1kΩ 5% 1/4W Resistor *
(brown-black-red-gold)

☐ D6 - Red Triangular LED
☐ D5 - Green Triangular LED
☐ 5/16" x 4 Tubing #20 (black)
(see Figure F)

☐ R2 - 1MΩ 5% 1/4W Resistor *
(brown-black-green-gold)

☐ R1 - 20kΩ 5% 1/4W Resistor
(red-black-orange-gold)
(see Figure D)

☐ C1 - 68pF (68) Discap

☐ R7 - 1kΩ 5% 1/4W Resistor *
(brown-black-red-gold)

☐ R4 - 470Ω 5% 1/4W Resistor *
(yellow-violet-brown-gold)

Figure A

Mount the speaker with the positive (+) lead in the hole marked (+) on the PC board as shown.

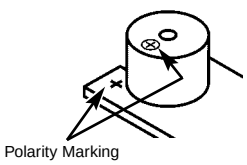
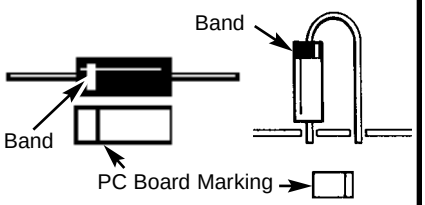


Figure B



Diodes have polarity, so be sure that the band is in the correct direction, as shown on the top legend of the PC board.

Figure C

Electrolytic capacitors have polarity. Mount the capacitor with the positive lead in the hole marked (+) on the PC board.

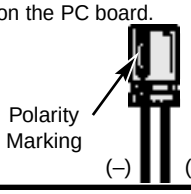


Figure D

Mount the resistor on end as shown.

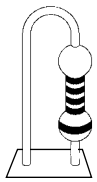


Figure E

Insert the IC socket into the PC board with the notch in the direction shown on the top legend. Solder the IC socket into place. Insert the IC into the socket with the notch in the same direction as the notch on the socket.

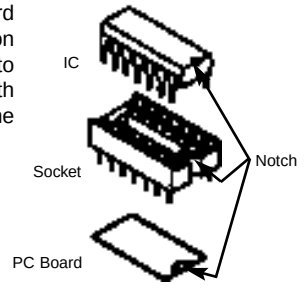
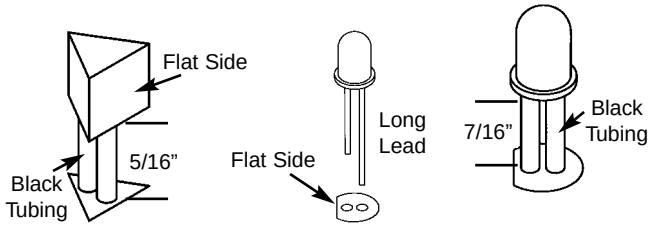


Figure F

Mount the LED as shown with the black tubing spacers. Be sure that the flat side is in the same direction as marked on the PC board.



FINAL ASSEMBLY

☐ Attach and solder the logic probe tip to the foil side of the PC board as shown in Figure G.

☐ Solder the power cord to the foil side of the PC board as shown in Figure H. The red wire goes to the pad marked J2 and the black wire goes to the pad marked J3.

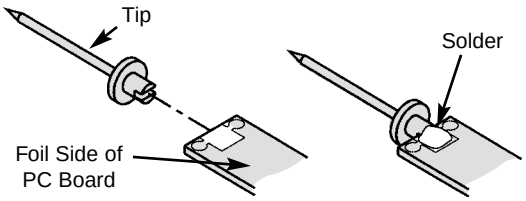
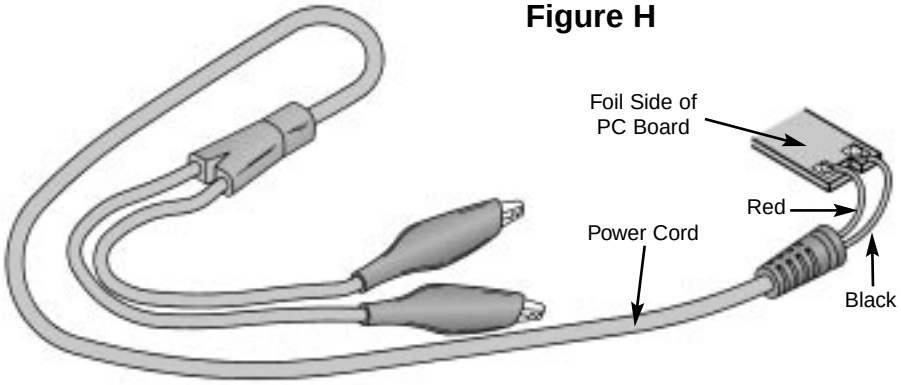


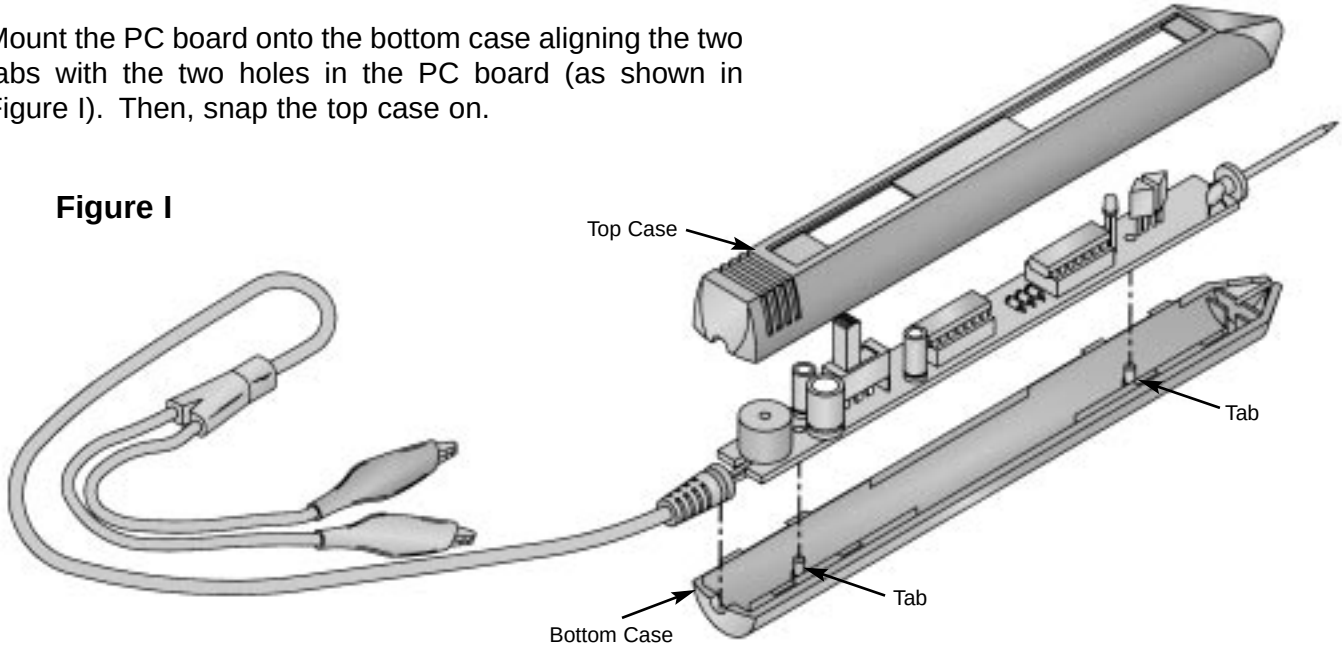
Figure G

Figure H



☐ Mount the PC board onto the bottom case aligning the two tabs with the two holes in the PC board (as shown in Figure I). Then, snap the top case on.

Figure I



☐ Peel the backing off of the label and stick the label onto the top case as shown in Figure J. Then, slide on the red tubing onto the tip as shown. Shrink the tubing by heating it with your soldering iron. Be sure that the soldering iron does not contact the tubing or plastic case.

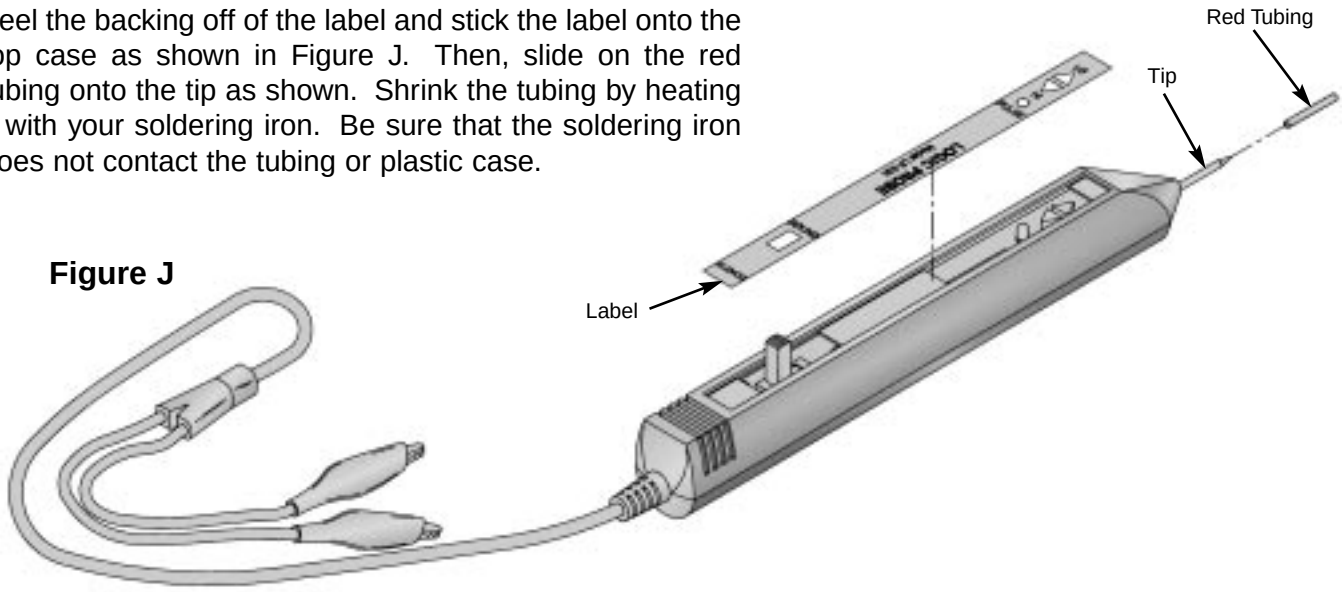


Figure J

OPERATING INSTRUCTIONS

To operate the logic probe, connect the two alligator clips to the circuit DC power supply (the red clip to the positive voltage and the black clip to ground). BE SURE THE POWER SUPPLY IS UNDER 35V OR DAMAGE MAY OCCUR TO THE PROBE. The green LED will light. Touch the probe tip to the circuit node to be analyzed. If the voltage of this point is ≥ 50% of the voltage power supply, the red LED will light to indicate the HI level voltage. If the sound switch is in the SOUND position, you will hear the beeper tone for the HI level voltage. If the sound switch is OFF, the same results occur with the LEDs but without sound.

When there are single pulses on the probe tip, the yellow LED will flicker with the frequency of input pulses. For continuous pulses, the yellow LED will stay lit.

Interpreting the LEDs

- ● LED On
- ○ LED Off
- * LED Blinking
- No Sound
- Sound

This information for switch to the sound position.

INPUT SIGNAL	LED STATES LO	HIGH	PULSE	SOUND	
	○	○	○		Probe not connected to power.
	●	○	○		Logic tip is not connected or Logic "0" no pulse activity.
	○	●	○		Logic "1" no pulse activity.
	●	○	*		Logic "0" with positive single pulses.
	○	●	*		Logic "1" with negative single pulses.
	●	○	●		Logic "0" with positive continuous pulses.
	○	●	●		Logic "1" with negative continuous pulses.

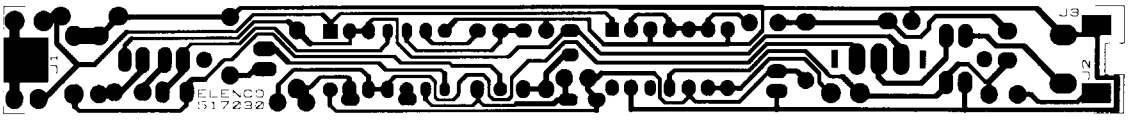
TROUBLESHOOTING

Contact Elenco Electronics if you have any problems. **DO NOT** contact your place of purchase as they will not be able to help you.

1. One of the most frequently occurring problems is poor solder connections.
   a) Tug slightly on all parts to make sure that they are indeed soldered.
   b) All solder connections should be shiny. Resolder any that are not.
   c) Solder should flow into a smooth puddle rather than a round ball. Resolder any connection that has formed into a ball.
   d) Have any solder bridges formed? A solder bridge may occur if you accidentally touch an adjacent foil by using too much solder or by dragging the soldering iron across adjacent foils. Break the bridge with your soldering iron. (See Figure K).

2. Be sure that all components have been mounted in their correct places.
   a) Be sure that the electrolytic capacitors C5, C8 and C9 have been installed correctly. These capacitors have polarity, so the negative and positive leads must be in the correct holes as marked on the top legend side of the PC board.
   b) Be sure that the LEDs are mounted as shown in Figure F.
   c) Be sure that the integrated circuits U1 and U2 are mounted with the notches in the same direction as marked on the PC board.
   d) Be sure that the speaker SP1 is mounted with the positive (+) lead in the correct hole as marked on the PC board.
   e) Be sure that the power cord has been installed correctly. The red wire goes to the pad marked J2 and the black wire goes to the pad marked J3. (See Figure K).
   f) Be sure that the diodes are mounted with the band in the same direction as marked on the PC board.

Figure K



Foil Side of PC Board

GLOSSARY

Alternating Current (AC) ..... Non-polarized power that is constantly changing back and forth between positive and negative.

Anode ..... The positive terminal of a diode or other polarized component.

Capacitor ..... Electrical component for accumulating energy.

Cathode ..... The negative terminal of a diode or other polarized component.

CMOS ..... (Complimentary Metal Oxide Semiconductor) A type of transistor circuit which uses P- and N-type field-effect transistors.

Current ..... The flow of electrons.

Diode ..... An electronic component that changes alternating current to direct current.

Direct Current (DC) ..... Voltage that has polarity.

Frequency ..... The number of cycles per second produced.

Impedance ..... In circuit, the opposition that circuit elements present to alternating current.

Input Impedance ..... The impedance seen by source when a device or circuit is connected across the source.

Integrated Circuit (IC) ..... Any of a huge number of semiconductor packages that contain entire elements.

Inverter ..... The circuit where the output state is the opposite of the input state.

Light Emitting Diode (LED) ..... A semiconductor device that glows when power is applied to its electrodes.

Logic Probe ..... An electronic test device that detects the status of a signal.

Oscillator ..... A device that moves back and forth between two boundaries.

PC Board ..... Printed Circuit Board.

Power Supply ..... An electronic circuit that produces the necessary power for another circuit or device.

Pulse ..... A sudden change from one level to another, followed after a time by a sudden change back to the original level.

Resistor ..... An electronic component that obstructs (resists) the flow of electricity.

Speaker ..... Component that converts electrical energy into sound energy.

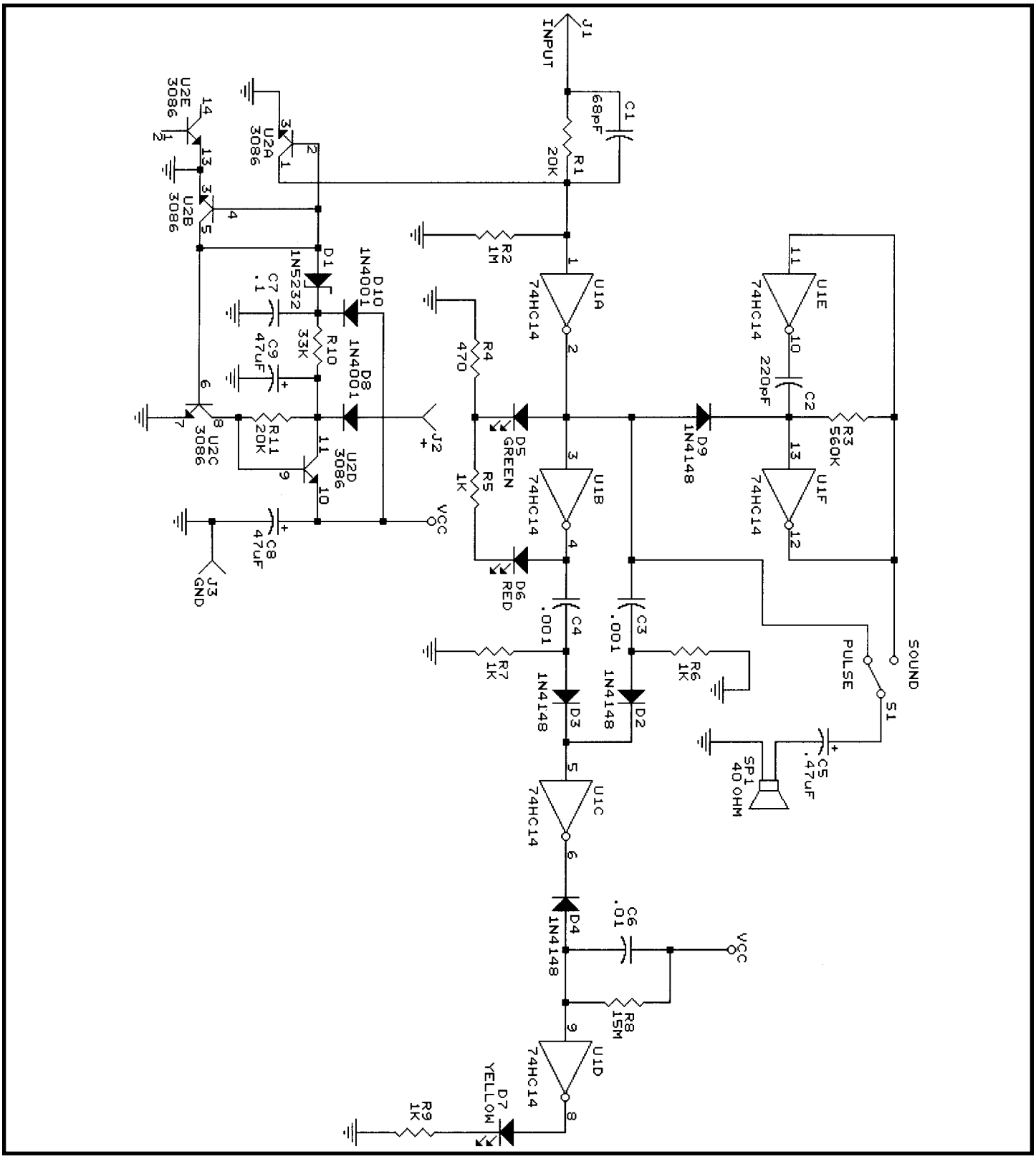
Troubleshoot ..... To find and fix the problem with something.

TTL (Transistor-Transistor Logic) A type of integrated circuit logic that uses bipolar junction transistors.

Voltage ..... The electromotive force that “pushes” electrons through conductive materials.

Zener ..... A type of diode that acts as a voltage regulator by restricting the flow of voltage above its rating.

SCHEMATIC DIAGRAM



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