

# LOVE TESTER KIT

MODEL AK-500



Assembly and Instruction Manual

## PARTS LIST

Contact Elenco Electronics (address/phone/e-mail is at the back of this manual) if any parts are missing or damaged. **DO NOT** contact your place of purchase as they will not be able to help you.

### RESISTORS

Qty	Symbol	Value	Color Code	Part #
□ 2	R1, R8	470Ω 5% 1/4W	yellow-violet-brown-gold	134700
□ 1	R5	15kΩ 5% 1/4W	brown-green-orange-gold	151500
□ 1	R2	56kΩ 5% 1/4W	green-blue-orange-gold	155600
□ 1	R7	68kΩ 5% 1/4W	blue-gray-orange-gold	156800
□ 1	R3	100kΩ 5% 1/4W	brown-black-yellow-gold	161000
□ 1	R4, R6	1.5MΩ 5% 1/4W	brown-green-green-gold	171500

### CAPACITORS

Qty	Symbol	Value	Description	Part #
□ 1	C1	.0039μF (392)	Mylar	233917
□ 1	C2	.015μF (153)	Mylar	241517
□ 1	C3	2.2μF 50V	Electrolytic (Lytic)	262247
□ 1	C4	47μF 16V	Electrolytic (Lytic)	274744

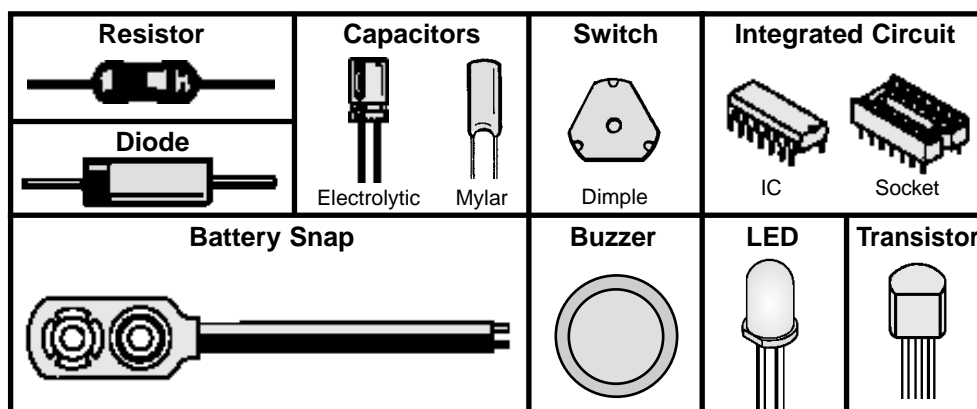
### SEMICONDUCTORS

Qty	Symbol	Value	Description	Part #
□ 1	D1	1N4148	Diode	314148
□ 1	Q1	2N3904	Transistor	323904
□ 1	U1	4011	Integrated Circuit (IC)	334011
□ 1	U2	4017	Integrated Circuit (IC)	334017
□ 8	LED 1 - 8		Light Emitting Diode (LED)	350001

### MISCELLANEOUS

Qty	Description	Part #	Qty	Description	Part #
□ 1	PC Board	517017	□ 1	Tape 2-sided 1"	748127
□ 1	Dimple Switch	546101	□ 1	Cushion Tape 1"	790006
□ 1	Battery Snap	590098	□ 1	Wire Red 22ga. 1"	814220
□ 1	Buzzer Piezoelectric	595201	□ 1	Wire Bare 24ga. 1"	835000
□ 1	Filter Red	621425	□ 1	Solder Tube	9ST4
□ 1	Spacer 7/32"	624008			

## PARTS IDENTIFICATION



## IDENTIFYING RESISTOR VALUES

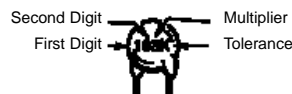
Use the following information as a guide in properly identifying the value of resistors.



BAND 1 1st Digit		BAND 2 2nd Digit		Multiplier		Resistance Tolerance	
Color	Digit	Color	Digit	Color	Multiplier	Color	Tolerance
Black	0	Black	0	Black	1	Silver	$\pm 10\%$
Brown	1	Brown	1	Brown	10	Gold	$\pm 5\%$
Red	2	Red	2	Red	100	Brown	$\pm 1\%$
Orange	3	Orange	3	Orange	1,000	Red	$\pm 2\%$
Yellow	4	Yellow	4	Yellow	10,000	Orange	$\pm 3\%$
Green	5	Green	5	Green	100,000	Green	$\pm .5\%$
Blue	6	Blue	6	Blue	1,000,000	Blue	$\pm .25\%$
Violet	7	Violet	7	Silver	0.01	Violet	$\pm .1\%$
Gray	8	Gray	8	Gold	0.1		
White	9	White	9				

## IDENTIFYING CAPACITOR VALUES

Capacitors will be identified by their capacitance value in pF (picofarads), nF (nanofarads), or  $\mu\text{F}$  (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

The above value is  $10 \times 1,000 = 10,000\text{pF}$  or  $.01\mu\text{F}$

The letter K indicates a tolerance of  $\pm 10\%$

The letter J indicates a tolerance of  $\pm 5\%$

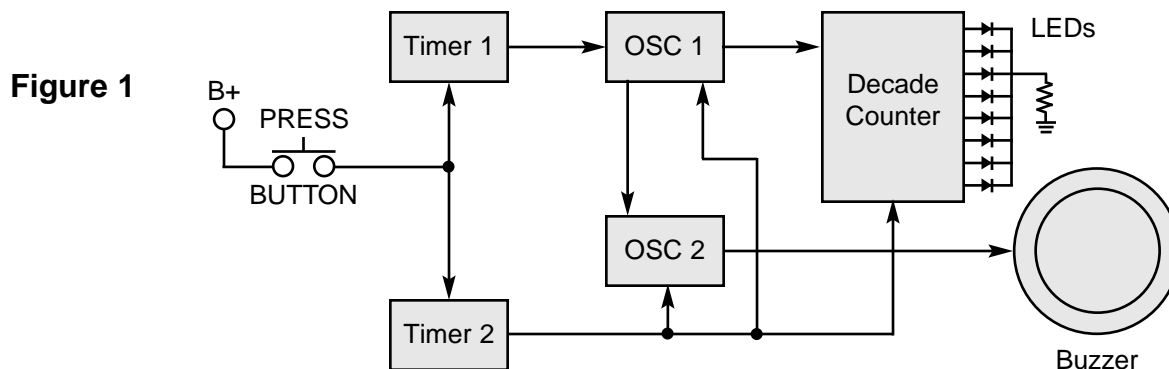
Note: The letter "R" may be used at times to signify a decimal point; as in 3R3 = 3.3

## INTRODUCTION

Want to know what kind of lover you are? Push the PRESS button and the Love Tester will rate you as a lover. The Love Tester has eight Light Emitting Diodes (LEDs) that are driven ON and OFF one at a time in sequence. When the PRESS button is pushed, the LEDs will flash and the buzzer will sound. After a brief period of time, only one LED will remain lit. Above the lit LED is your rating as a lover, anywhere from Cold Fish to Hot Stuff. In a minute or two, the LED will get dim and gradually go out.

## THEORY OF OPERATION

Figure 1 shows the block diagram of the Love Tester circuit. It consists of two oscillators and eight LEDs driven by a decade counter. One oscillator drives the decade counter and the oscillators are controlled by two timers. We shall proceed to study the circuit in detail.



## THE DECADE COUNTER

The 4017 IC is a 5 stage divide by 10 counter. Figure 2 shows a diagram of this IC. This IC has 10 outputs and a clear input. Only one of the 10 outputs will be high at any given time. The other 9 will be low. Let's assume that output 1 is high. If a pulse is fed into the clock input, output 1 will go low and output 2 will go high. Each clock pulse will move the output one position. Connect an LED to the output, it will light only when the output goes high. It is obvious that when the clock is running, the LEDs will flash on and off with the speed of the clock. When the clock stops, only one LED will be lit.

In this design, 8 LEDs are used per IC, but the counter has 10 outputs. If the clock stops at an output without an LED, nothing will light. To prevent this, the 4017 IC is reset after hitting the 8th output. This is simply done by tying the 9th output to the clear pin (pin 9 and pin 15 shorted together).

## Block Diagram

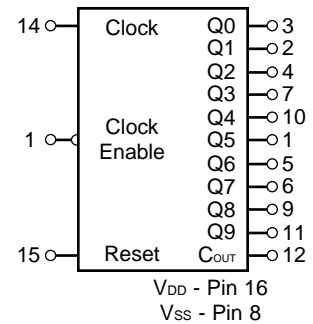


Figure 2

## THE LIGHT EMITTING DIODES (LED)

The operation of the LED is very simple. When current flows through the LED, it will emit light. Note that the LED is connected between an IC output and ground through a resistor. When the IC output goes high, the LED will light. The resistor limits the current so that the LED will not be damaged.

## OSCILLATORS

The Love Tester uses two oscillators. The first oscillator produces a frequency of about 20 hertz (cycles) and the other produces a frequency of about 2000 hertz. Figure 3 shows the basic oscillator circuit. The 4011 integrated circuit (IC) contains four two-input NAND gates. Two of these NAND gates are needed to form an oscillator. Feed back for this oscillator is via capacitor C2 and resistors R4 and R5. These elements determine the frequency of oscillation. Both IC1 and IC2 act as inverters, that is, when the input is low, the output is high. As long as pin 13 of IC1 is high, the circuit will oscillate. If pin 13 is brought low, the circuit will stop oscillating.

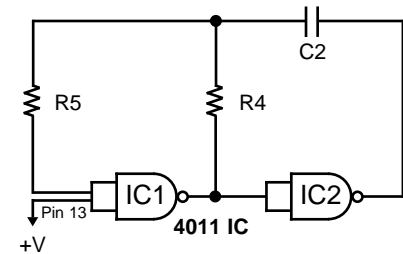


Figure 3

The second oscillator is similar to the one described except for a difference in its frequency controlling components, capacitor C1 and resistors R2 and R3. C1 and R2 are smaller values causing the oscillator to oscillate at a much higher frequency. Pin 6 of the first NAND gate is brought high at a 20 cycles rate. This causes the second oscillation to be chopped up at the first oscillation frequency rate as shown in Figure 4. This combination produces the unusual sound heard from the buzzer.



Figure 4

## BUZZER

The Love Tester buzzer consists of a piezoelectric material on a metal base. When a voltage is applied to piezoelectric material, its dimensions change. The buzzer is connected to the 2kHz oscillator. When the oscillator runs, the changing dimensions to the piezoelectric buzzer act like the cone of a speaker to set up sound waves.

## TIMER

Timer 1 is made up of capacitor C3 and R6. Timer 2 is made up of capacitor C4 and R7 (see schematic diagram). When S1 is pushed, both capacitors charge up to 9 volts and the oscillators run. When the switch is released, capacitor C3 discharges through resistor R6 and capacitor C4 discharges through resistor R7 and the base of Q1.

Note that C3 is tied to pin 13 of the 4011 IC. Thus, when capacitor C3 loses its charge, the circuit stops oscillating. The buzzer stops and a single LED remains lit. After a minute or two, C4 loses its charge and removes the base current from Q1. Q1 is in the ground return path of the LEDs and both ICs. Thus, when Q1 is turned off, the LED goes out. Only a very small leakage current is then drawn from the battery. This current is so small that no ON/OFF switch is required.

# CONSTRUCTION

## Introduction

The most important factor in assembling your AK-500 Love Tester 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.**

## 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 in the board and are soldered on the foil side.

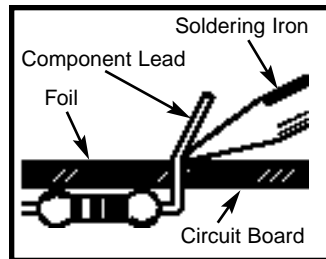
**Use only rosin core solder of 63/37 alloy.**

**DO NOT USE ACID CORE SOLDER!**

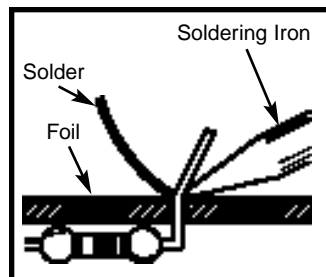
## What Good Soldering Looks Like

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

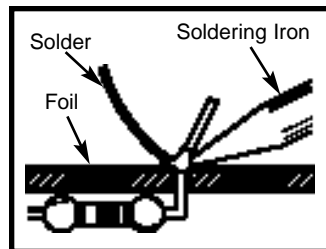
1. Solder all components from the copper foil side only. Push the soldering iron tip against both the lead and the circuit board foil.



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.

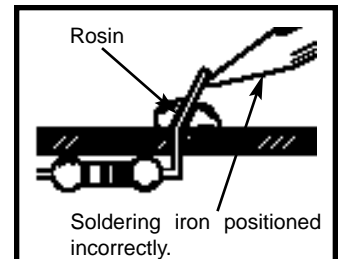


4. Here is what a good solder connection looks like.

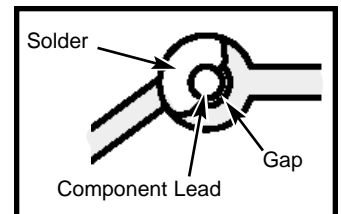


## Types of Poor Soldering Connections

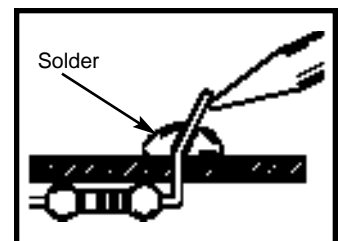
1. **Insufficient heat** - the solder will not flow onto the lead as shown.



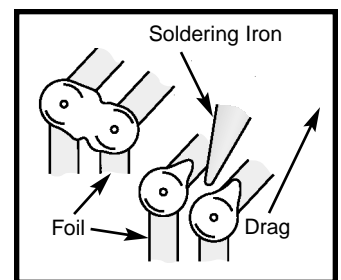
2. **Insufficient solder** - let the solder flow over the connection until it is covered. Use just enough solder to cover the connection.



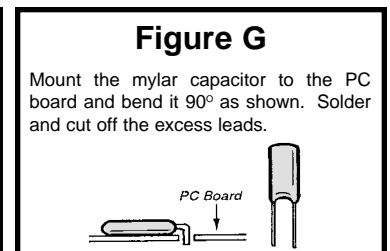
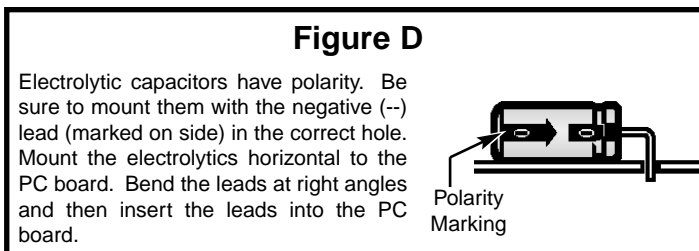
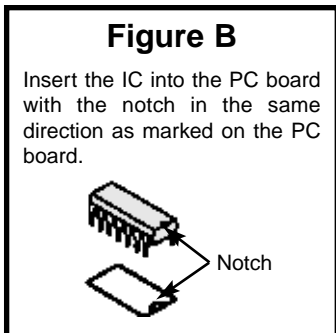
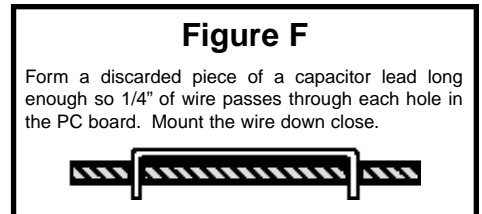
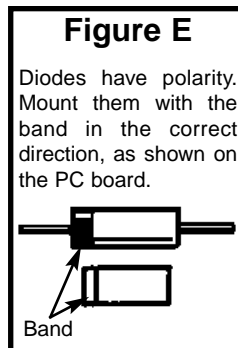
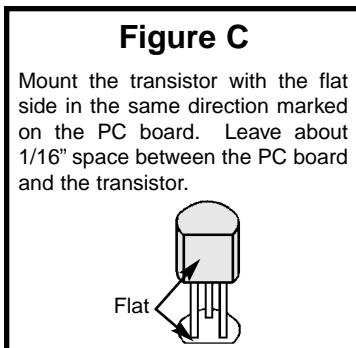
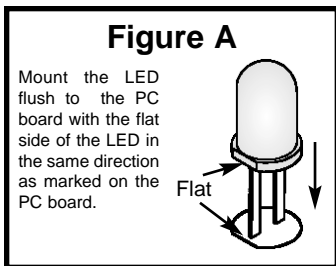
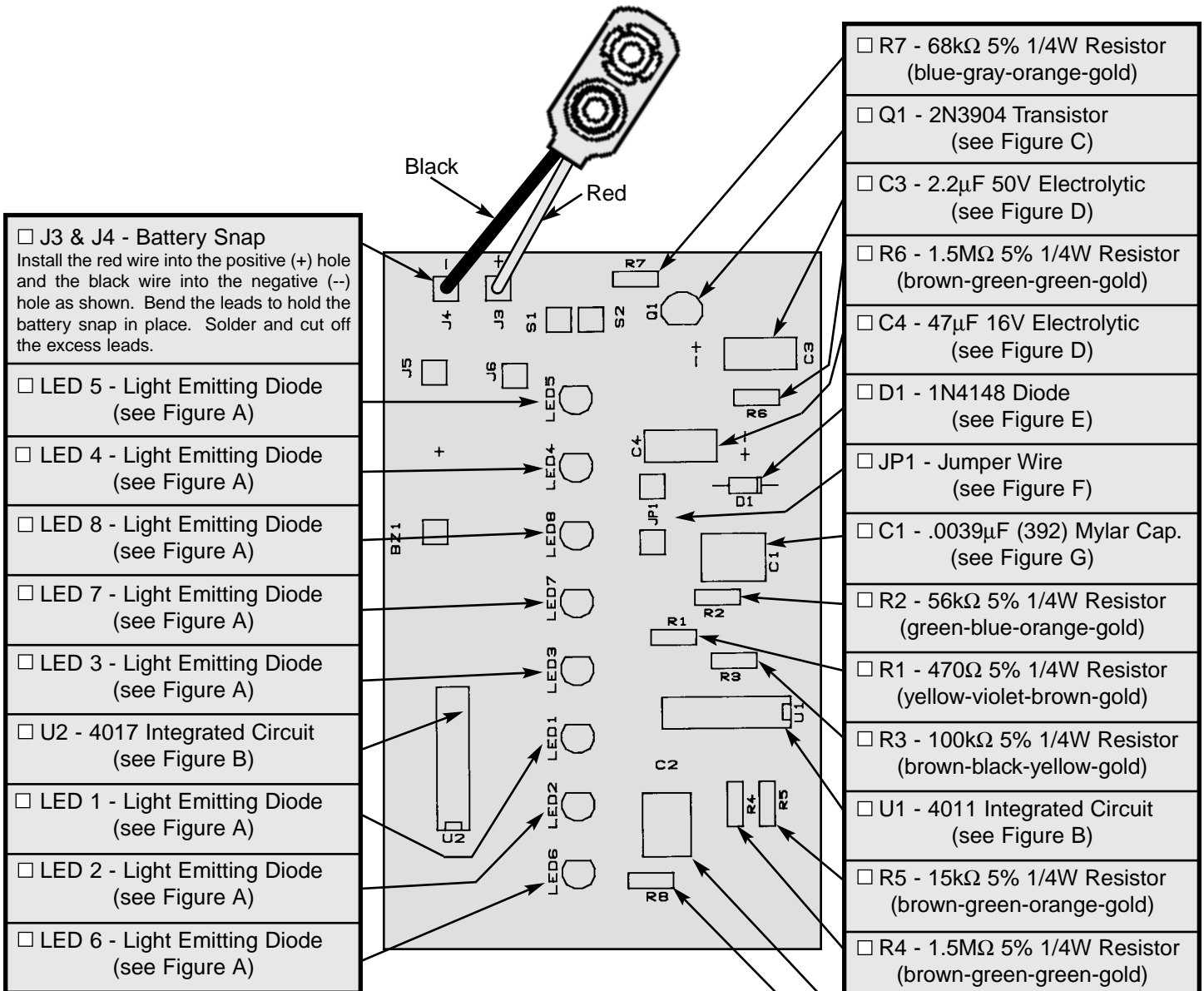
3. **Excessive solder** - could make connections that you did not intend to between adjacent foil areas or terminals.



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.



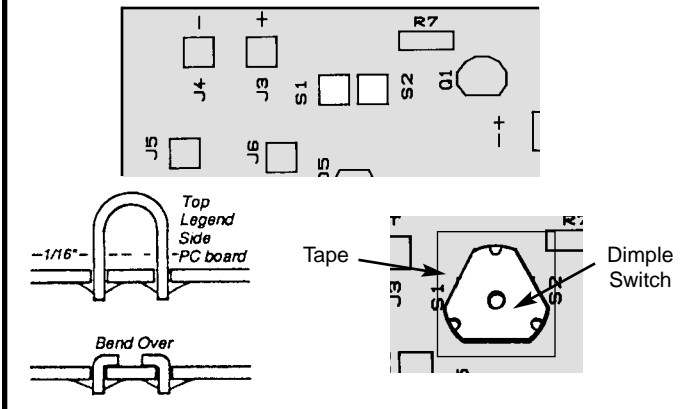
# ASSEMBLE COMPONENTS TO THE PC BOARD



# ASSEMBLE COMPONENTS TO THE PC BOARD (CONTINUED)

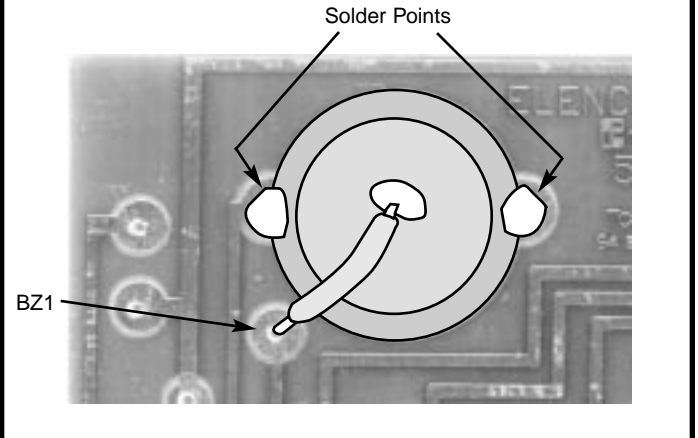
**Figure I**

Solder the 1" 24 ga. bare wire to S1 and S2 as shown. Cut the wire so that each end extends 1/16" above the PC board. Then, bend the wires toward each other and also press them flat against the PC board with your pliers. Place the dimple switch with the dome upward over the S1 and S2 wires. Hold the switch in place with the double-sided tape. Mount the spacer on top of the switch, the double-sided tape on the switch will hold it in place.

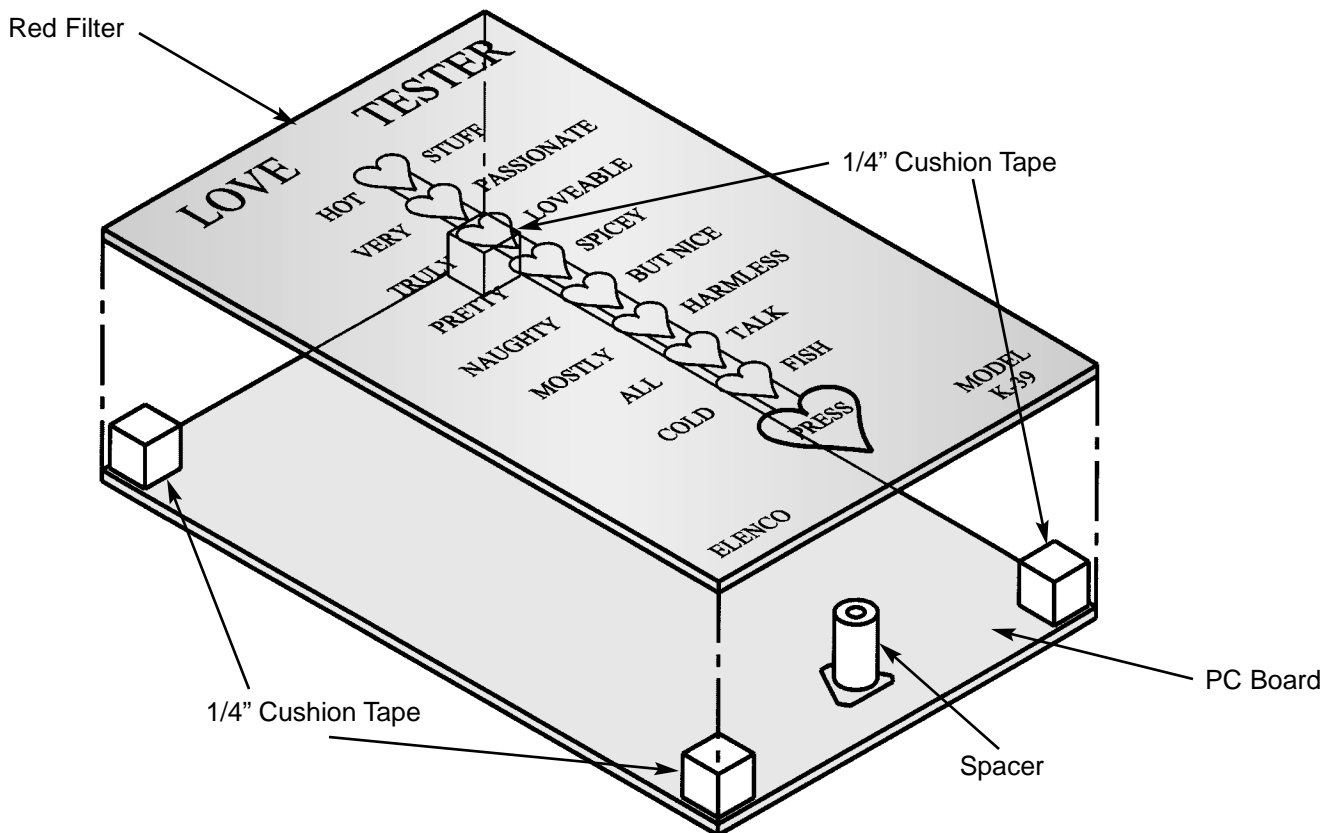


**Figure H**

Mount the buzzer on the foil side of the PC board. The white center should be facing up, also note the position of the pad in the white area. Solder the buzzer to the PC board at the two points. Strip the insulation off of both ends of the red wire to expose 1/8" of bare wire. Solder the wire to the buzzer and PC board.



- Cut the cushion tape into four equal 1/4" sections. Peel off the protective film on one side of the tape and stick a section of tape on each corner of the PC board on the top legend side (see Figure J). Place the spacer over the dimple switch as shown in Figure J. Peel off the protective film on the other side of the tape and stick the red filter in place so that the "press" heart is directly over the spacer on the switch (see Figure J).



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## OPERATING PROCEDURE

Operating your Love Tester is very simple. Just connect a 9 volt battery to the battery snap and you are ready to go. Push the PRESS button to get your rating as a lover!

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## 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.
2. Be sure that all components have been mounted in their correct places.
  - a) The LEDs will not light if they have not been installed correctly. The flat side of the LEDs should be in the same direction as marked on the PC board.
  - b) Be sure capacitors C3 and C4 are installed correctly. These capacitors are polarized so be sure that the positive and negative leads are in the correct hole as marked on the PC board.
  - c) Be sure that ICs U1 and U2 are installed correctly. The notch should be in the direction shown on the PC board.
  - d) Be sure that transistor Q1 has been installed correctly. The flat side of the transistor should be in the same direction as marked on the PC board.
  - e) Be sure that diode D1 is installed correctly. The stripe on the diode should be in the same direction as the stripe marked on the PC board.
3. Use a fresh 9 volt **ALKALINE** battery.
4. **NO SOUND AND NO LEDs**
  - a) Check that the battery snap is wired as shown on page 5 of this manual. The black wire goes to J4 (--) and the red wire goes to J3 (+).
  - b) Check that U1 and U2 are not installed backwards. Be sure that there are no solder bridges between the IC pins.
  - c) Check that the dimple switch is mounted with the dome upward.
  - d) Check the value and the soldering of R7.
  - e) Check Q1.
5. **CONTINUOUS SOUND AND LED**
  - a) Check the wires in S1 and S2. They should make contact with the dimple switch only when the "PRESS" heart on the red filter is pressed.
6. **LEDs BUT NO SOUND**
  - a) Check that the buzzer is soldered as shown in Figure D on page 5. Check that the solder connection between the jumper wire and the center pad of the buzzer.
  - b) Check for soldering bridges between the pins of U1.
  - c) Check the value and the soldering of R1, R2, and R3.
7. **LEDs STOP AS SOON AS THE SWITCH IS RELEASED**
  - a) Check that C3 and C4 are mounted with the negative (--) lead in the hole marked on the PC board.
  - b) Check the value and soldering of R6.
  - c) Check D1.

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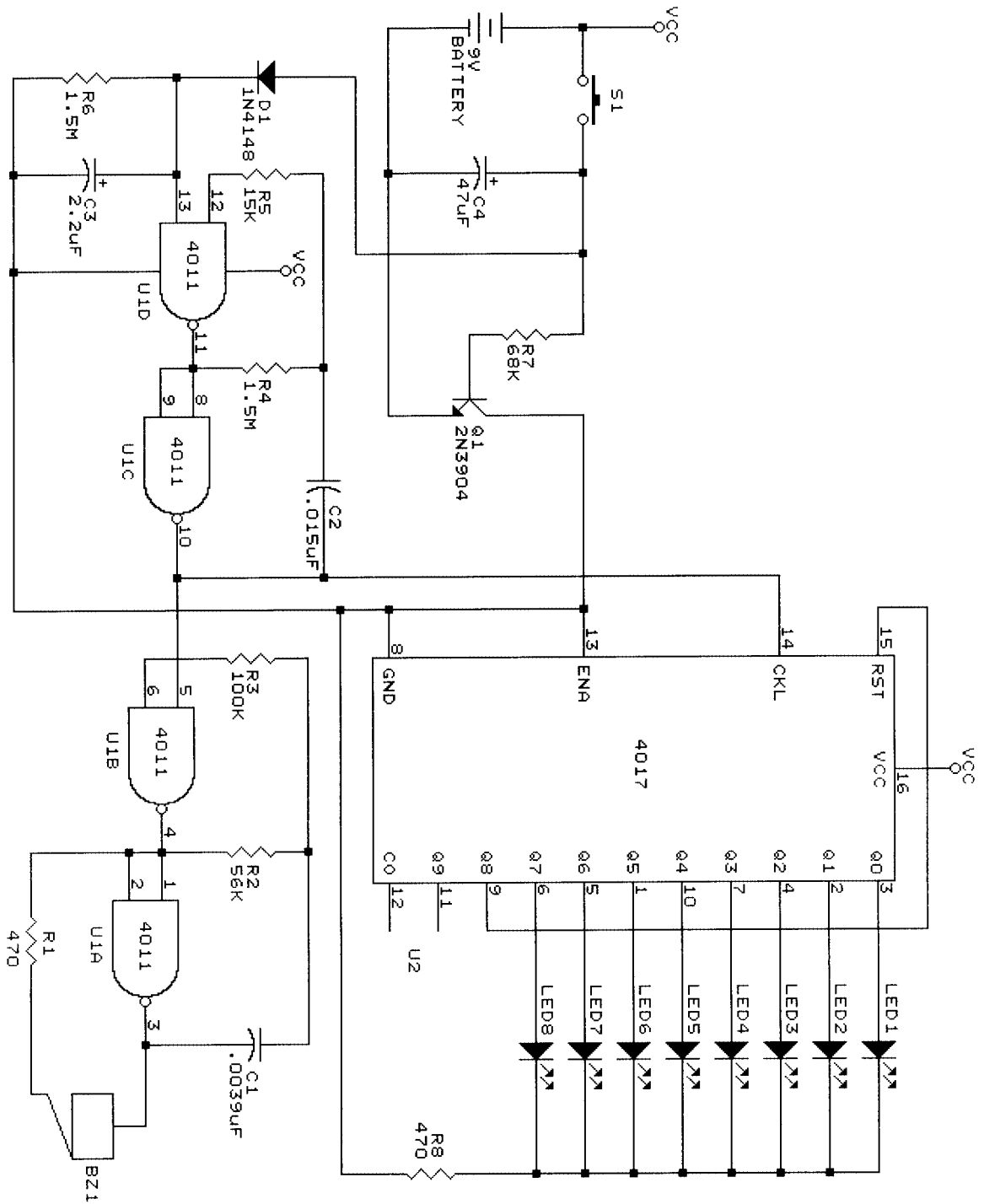
## QUIZ

Fill in the blanks and check your answers below.

1. When driven by clock pulses, the outputs of the decade counter will go on and \_\_\_\_\_ at a time in sequence.
2. LEDs are driven by a \_\_\_\_\_.
3. The 4017 IC contains a \_\_\_\_\_ stage divide by \_\_\_\_\_ counter.
4. The Love Tester uses \_\_\_\_\_ oscillators.
5. The 4011 IC contains four two input \_\_\_\_\_ gates.
6. When a voltage is applied to the piezoelectric buzzer, it changes its \_\_\_\_\_.
7. When the PRESS button is pushed, capacitors C3 and C4 charge up to 9V, and the \_\_\_\_\_ start running.
8. After the oscillators stop, only one LED will remain lit and then gradually fade out as \_\_\_\_\_ loses its charge.

Answers: 1. off; 2. decade counter; 3. five, ten; 4. two; 5. NAND; 6. dimension; 7. oscillator; 8. C4

# SCHEMATIC DIAGRAM



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## NOTES

