LOGIC PULSER KIT

MODEL LP-425K

Assembly and Instruction Manual

ELENCO®

 Revised 2016 REV-E 753262

PARTS LIST

If you are a student, and any parts are missing or damaged, please see instructor or bookstore.
If you purchased this logic pulser kit from a distributor, catalog, etc., please contact ELENCO® (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 #
❒ 2	R1, R16	100Ω 5% 1/4W	brown-black-brown-gold	131000
❒ 1	R17	470Ω 5% 1/4W	yellow-violet-brown-gold	134700
❒ 2	R11, R13	2kΩ 5% 1/4W	red-black-red-gold	142000
❒ 3	R12, R14, R15	20kΩ 5% 1/4W	red-black-orange-gold	152000
❒ 1	R8	68kΩ 5% 1/4W	blue-gray-orange-gold	156800
❒ 4	R2, R7, R9, R10	100kΩ 5% 1/4W	brown-black-yellow-gold	161000
❒ 1	R5	1MΩ 5% 1/4W	brown-black-green-gold	171000
❒ 2	R3, R6	1.8MΩ 5% 1/4W	brown-gray-green-gold	171800
❒ 1	R4	10MΩ 5% 1/4W	brown-black-blue-gold	181000

CAPACITORS

Qty.	Symbol	Description	Part #	Qty.	Symbol	Description	Part #
❒ 2	C6, C7	100pF (101) Discap	221017	❒ 1	C5	1μF Tantalum	260010
❒ 1	C4	0.001μF (102) Mylar	231017	❒ 1	C8	10μF Lytic 35V	271016
❒ 1	C3	0.01μF (103) Mylar	241017	❒ 1	C2	22μF Lytic 25V	272245
❒ 1	C1	0.1μF (104) Discap	251010				

SEMICONDUCTORS

Qty.	Symbol	Description	Part #	Qty.	Symbol	Description	Part #
❒ 3	D1,D4,D5	Diode 1N4001	314001	❒ 2	Q2, Q3	2N3906 Transistor	323906
❒ 1	D3	Diode 1N4148	314148	❒ 1	U1	IC 4069 ***or*** 74C04	334069
❒ 1	D2	Diode Zener 1N5246	315246				***or*** 34C004
❒ 3	Q1,Q4,Q5	Transistor 2N3904	323904	❒ 1	D6	LED	350001

MISCELLANEOUS

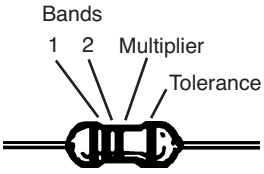
Qty.	Description	Part #	Qty.	Description	Part #
❒ 1	PC Board	517009	❒ 1	Alligator Clip Red	680002
❒ 1	Switch SPDT	541024	❒ 1	Label Front	724005
❒ 1	Pulser Tip	616001	❒ 1	Label Back	724006
❒ 1	Case	623005	❒ 1	Wire 22 Gauge Red 1.5”	814220
❒ 2	Screw #4 x 5/8”	643450	❒ 3’	Wire 2 Conductor	870500
❒ 1	IC Socket 14-pin	664014	❒ 1”	Tubing #20	890020
❒ 3	Pins	665001	❒ 1”	Shrink Tubing (red)	890312
❒ 1	Alligator Clip Black	680001	❒ 1	Solder Tube	9ST4

SPECIFICATIONS

Maximum Allowable Supply Voltage	±20V, ±25V/15 sec.
Maximum Allowable Voltage on Output	±35V
Maximum Sync. Input Voltage	±120V/15 sec.
Operating Supply Voltage Range	4 - 15VDC
Free Air Operating Temperature Range	0 - 50°C
Output Pulse Width at 100mA Load	10μS
Output Current	
1) Pulser Mode	100mA Sink/Source
2) Square Wave Output	5mA Sink/Source
Pulse Repetition Rate	0.5PPS / 400PPS
Sync. Input Impedance	1MΩ

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

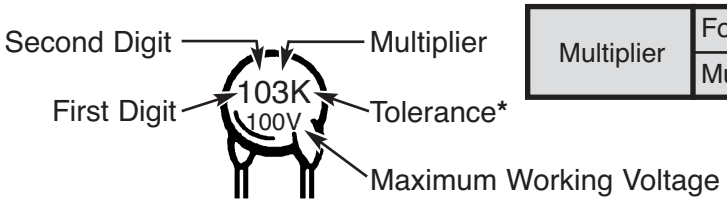
BAND 2 2nd Digit	
Color	Digit
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

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. The maximum operating voltage may also be printed on the capacitor.



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

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

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

*The letter M indicates a tolerance of ±20%
The letter K indicates a tolerance of ±10%
The letter J indicates a tolerance of ±5%

INTRODUCTION

Assembly of your LP-425 Logic Pulser will prove to be an exciting project and give much satisfaction and personal achievement. If you have experience in soldering and wiring technique, you should have no problems. For the beginner, care must be given in identifying the proper components and in good soldering habits. Above all, take your time and follow the easy step-by-step instructions. Remember, "an ounce of prevention is worth a pound of cure". Avoid making mistakes and no problems will occur.

CIRCUIT DESCRIPTION

The Elenco® Model LP-425 Logic Pulser is a very handy device for inspecting and repairing logic circuits. By injecting a signal directly to the circuit, you can avoid removing the ICs or other circuit components. The Logic Pulser will thus help you to troubleshoot wiring errors and malfunctioning components. The Logic Pulser operates by producing a large transient current for a short period of time. This will not harm the components under test since the average current is very small. The injected voltage is produced by the transient current flowing through the inherent resistance of the circuit.

The LP-425 Logic Pulser can produce a 10 microsecond pulse at 100mA load. The signal frequency can be set to .5Hz or 400Hz by the pulse repetition rate switch on the front of the Logic Pulser. This feature makes the Logic Pulser a very effective tool. The Logic Pulser also has a square wave output terminal (SQ). When the pulse repetition rate switch is set to 400Hz, the signal on the square wave terminal is a square wave. When the switch is set to 0.5Hz, the signal on the terminal is a pulse, high for 90% of the time and ground for the remaining 10%. The sync input terminal (SYNC) Logic Pulser can be used to produce an externally synchonized signal at the output.

CONSTRUCTION

Introduction

The most important factor in assembling your LP-425K Logic Pulser Kit is good soldering techniques. Using the proper soldering iron is of prime importance. A small pencil type soldering iron of 25 watts is recommended. **The tip of the iron must be kept clean at all times and well-tinned.**

Solder

For many years leaded solder was the most common type of solder used by the electronics industry, but it is now being replaced by lead-free solder for health reasons. This kit contains lead-free solder, which contains 99.3% tin, 0.7% copper, and has a rosin-flux core.

Lead-free solder is different from lead solder: It has a higher melting point than lead solder, so you need higher temperature for the solder to flow properly. Recommended tip temperature is approximately 700°F; higher temperatures improve solder flow but accelerate tip decay. An increase in soldering time may be required to achieve good results. Soldering iron tips wear out faster since lead-free solders are more corrosive and the higher soldering temperatures accelerate corrosion, so proper tip care is important. The solder joint finish will look slightly duller with lead-free solders.

Use these procedures to increase the life of your soldering iron tip when using lead-free solder:

- Keep the iron tinned at all times.
- Use the correct tip size for best heat transfer. The conical tip is the most commonly used.
- Turn off iron when not in use or reduce temperature setting when using a soldering station.
- Tips should be cleaned frequently to remove oxidation before it becomes impossible to remove. Use Dry Tip Cleaner (Elenco® #SH-1025) or Tip Cleaner (Elenco® #TTC1). If you use a sponge to clean your tip, then use distilled water (tap water has impurities that accelerate corrosion).

Safety Procedures

- **Always wear safety glasses or safety goggles to protect your eyes when working with tools or soldering iron, and during all phases of testing.**
- Be sure there is **adequate ventilation** when soldering.
- Locate soldering iron in an area where you do not have to go around it or reach over it. Keep it in a safe area away from the reach of children.
- **Do not hold solder in your mouth.** Solder is a toxic substance. Wash hands thoroughly after handling solder.

Assemble Components

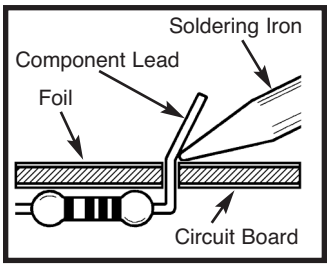
In all of the following assembly steps, the components must be installed on the top side of the PC board unless otherwise indicated. The top legend shows where each component goes. The leads pass through the corresponding holes in the board and are soldered on the foil side.
Use only rosin core solder.

DO NOT USE ACID CORE SOLDER!

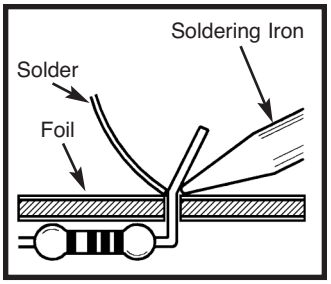
What Good Soldering Looks Like

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

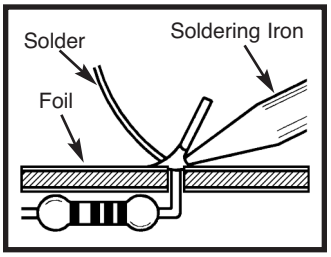
1. Solder all components from the copper foil side only. Push the soldering iron tip against both the lead and the circuit board foil.



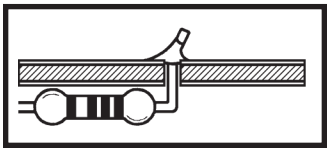
2. Apply a small amount of solder to the iron tip. This allows the heat to leave the iron and onto the foil. Immediately apply solder to the opposite side of the connection, away from the iron. Allow the heated component and the circuit foil to melt the solder.



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.

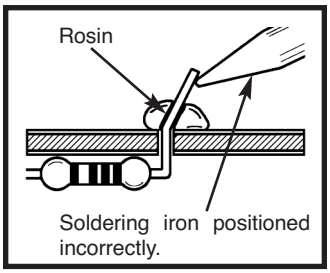


4. Here is what a good solder connection looks like.

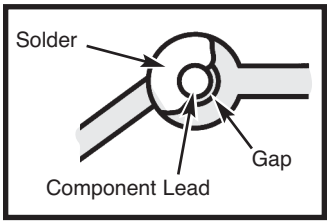


Types of Poor Soldering Connections

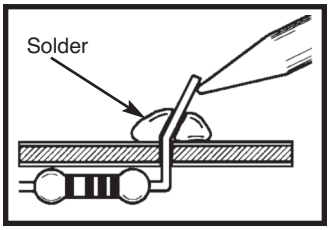
1. **Insufficient heat** - the solder will not flow onto the lead as shown.



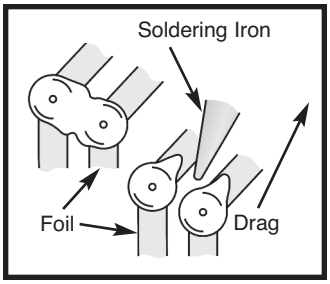
2. **Insufficient solder** - let the solder flow over the connection until it is covered.
Use just enough solder to cover the connection.



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



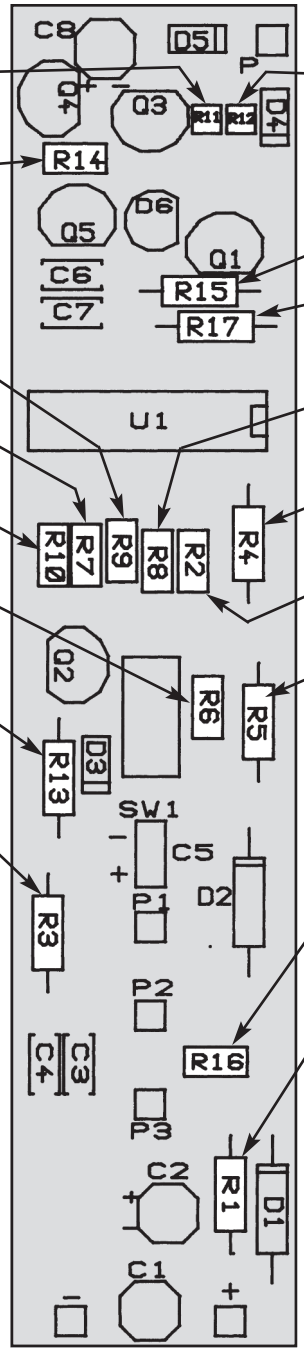
4. **Solder bridges** - occur when solder runs between circuit paths and creates a short circuit. This is usually caused by using too much solder.
To correct this, simply drag your soldering iron across the solder bridge as shown.



ASSEMBLE COMPONENTS TO THE PC BOARD

Refer to the top legend on the PC board, install and solder the following resistors. All are 1/4 watt, 5% tolerance. (Resistors R11 and R12 install vertical).

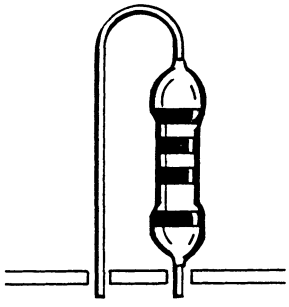
- ☐ R11 - 2kΩ Resistor (red-black-red-gold) (see Figure 1)
- ☐ R14 - 20kΩ Resistor (red-black-orange-gold)
- ☐ R9 - 100kΩ Resistor (brown-black-yellow-gold)
- ☐ R7 - 100kΩ Resistor (brown-black-yellow-gold)
- ☐ R10 - 100kΩ Resistor (brown-black-yellow-gold)
- ☐ R6 - 1.8MΩ Resistor (brown-gray-green-gold)
- ☐ R13 - 2kΩ Resistor (red-black-red-gold)
- ☐ R3 - 1.8MΩ Resistor (brown-gray-green-gold)



- ☐ R12 - 20kΩ Resistor (red-black-orange-gold) (see Figure 1)
- ☐ R15 - 20kΩ Resistor (red-black-orange-gold)
- ☐ R17 - 470Ω Resistor (yellow-violet-brown-gold)
- ☐ R8 - 68kΩ Resistor (blue-gray-orange-gold)
- ☐ R4 - 10MΩ Resistor (brown-black-blue-gold)
- ☐ R2 - 100kΩ Resistor (brown-black-yellow-gold)
- ☐ R5 - 1MΩ Resistor (brown-black-green-gold)
- ☐ R16 - 100Ω Resistor (brown-black-brown-gold)
- ☐ R1 - 100Ω Resistor (brown-black-brown-gold)

Figure 1

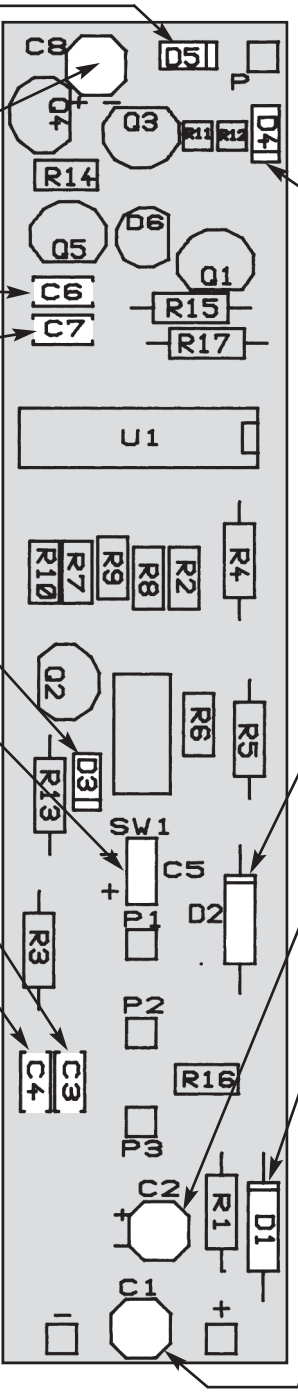
Stand resistor on end.



ASSEMBLE COMPONENTS TO THE PC BOARD

Refer to the top legend on the PC board, install and solder the following diodes and capacitors.

- ☐ D5 - 1N4001 Diode (see Figure 2)
- ☐ C8 - 10μF Lytic Capacitor (see Figure 3A)
- ☐ C6 - 100pF Discap (may be marked 101)
- ☐ C7 - 100pF Discap (may be marked 101)
- ☐ D3 - 1N4148 Diode (see Figure 2)
- ☐ C5 - 1μF Tantalum (may be marked 105) (see Figure 3B)
- ☐ C3 - 0.01μF Mylar Capacitor (may be marked 103)
- ☐ C4 - 0.001μF Mylar Capacitor (may be marked 102)



- ☐ D4 - 1N4001 Diode (see Figure 2)
- ☐ D2 - 1N5246 Zener Diode (see Figure 2)
- ☐ C2 - 22μF Lytic Capacitor (see Figure 3A)
- ☐ D1 - 1N4001 Diode (see Figure 2)
- ☐ C1 - 0.1μF Discap (may be marked 104)

Figure 2

When mounting diodes horizontally, mount as indicated by the band (diodes have polarity).

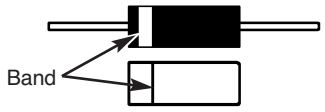


Figure 3A

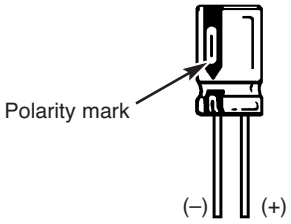
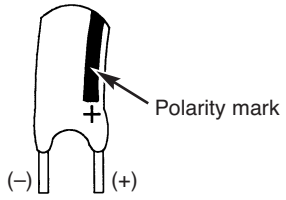


Figure 3B

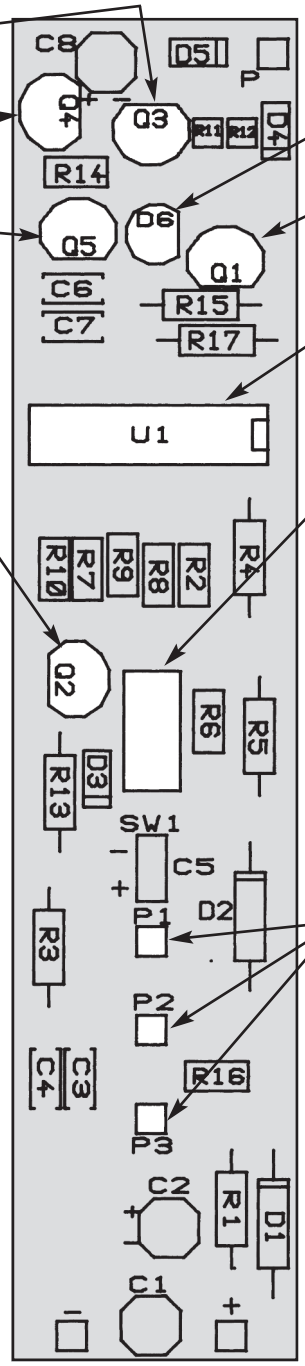


Some capacitors have polarity markings indicating the positive (+) or negative (–) lead. The PC board is marked to show the lead positions.

ASSEMBLE COMPONENTS TO THE PC BOARD

Refer to the top legend on the PC board, install and solder the following components.

- ☐ Q3 - 2N3906 Transistor (see Figure 7)
- ☐ Q4 - 2N3904 Transistor (see Figure 7)
- ☐ Q5 - 2N3904 Transistor (see Figure 7)
- ☐ Q2 - 2N3906 Transistor (see Figure 7)



- ☐ D6 - LED (see Figure 8)
- ☐ Q1 - 2N3904 Transistor (see Figure 7)
- ☐ U1 - 14-Pin IC Socket
- ☐ U1 - 74C04 IC or 4069 (see Figure 5)
- ☐ SW1 - Switch (see Figure 6)
- ☐ P1, P2, P3 - Pins

Do not install the pins to the PC board. They will be installed later. Tin (that is, put a small amount of solder on) the foil around the holes for the three pins. **Do not block the hole.** Tin the bottom fo the pin as shown in Figure 4.

Figure 4

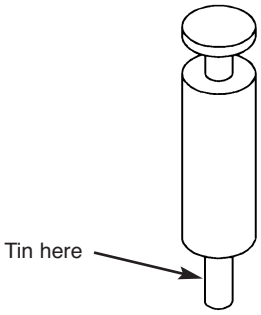


Figure 5

Install and solder the IC socket. Insert the IC into the socket with the notch in the direction shown on the top legend.

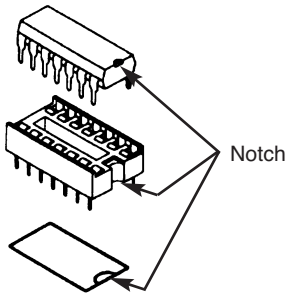


Figure 6

Insert the tabs and terminals into the PC board. Solder terminals only.

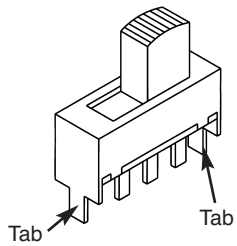


Figure 7

Mount the transistor with the flat side in the direction shown on the top legend. Leave 1/4" between the part and PC board.

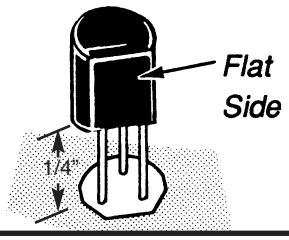
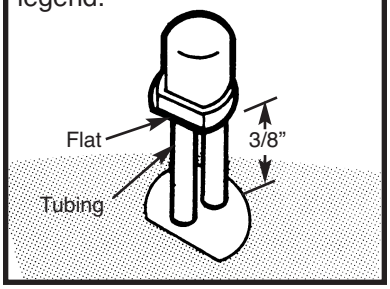


Figure 8

Cut a 3/8" piece of tubing for each LED lead, to be used as stand-offs. Mount the LED with the flat side in the direction shown on the top legend.



❒ Install the power cord as shown in Figure 9. Pull the power cord wires apart about 2 inches on one end. Strip the insulation off of both wires to expose 1/4" of bare wire. Note that one wire is ribbed on the edge. Solder the red alligator clip to the ribbed wire. Solder the black clip to the smooth wire. On the other side of the power cord, pull the wires apart 1/2". Strip 1/4" of insulation off of both wires. Make a knot to serve as a strain relief (about 1 inch from the end). Solder the ribbed wire to the hole marked "+" and the smooth wire to the hole marked "–".

❒ Install the pulser tip as shown in Figure 10. Using the 1 1/2" wire, strip 1/4" of insulation off of both ends. Solder one end to point P on the PC board. Solder the other end of the wire to the pulser tip groove.

❒ Punch out the five holes in the front label. Peel the backing off the front and back labels and stick them to the case as shown in Figure 11. The front label should be placed toward the back of the indent (toward the 3 pins) so that the LED and switch holes align with the case holes.

❒ Insert the 3 pins P1, P2, and P3 into their holes in the front label. Insert the PC board into the case so that the LED and switch protrude through the label (see Figure 11). Insert the 3 pins into the PC board and solder (see Figure 4).

❒ Place the unit into the case bottom and fasten with two #4 screws. Do not over-tighten or the holes may strip out.

❒ Cut a 13/16" piece of red shrink tubing and slide it over the pulser tip until it touches the plastic case. Shrink the tubing by heating it with your soldering iron. Be sure the soldering iron does not contact the tubing or plastic case.

This completes the assembly procedure. Your Logic Pulser is now ready for testing.

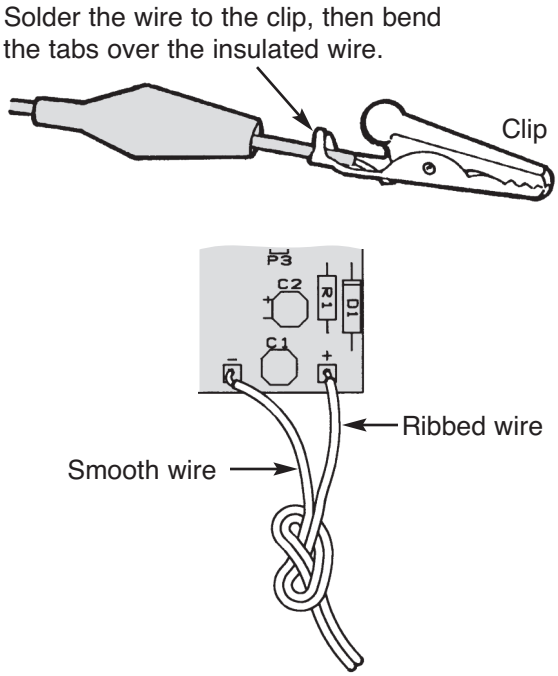


Figure 9

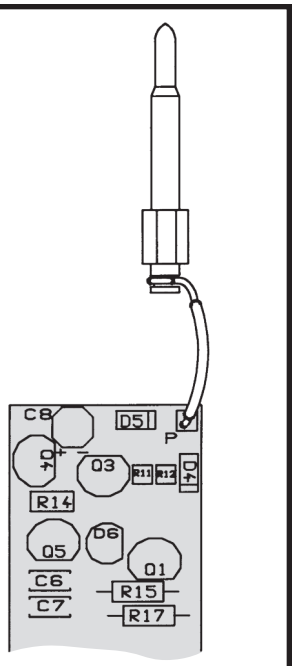


Figure 10

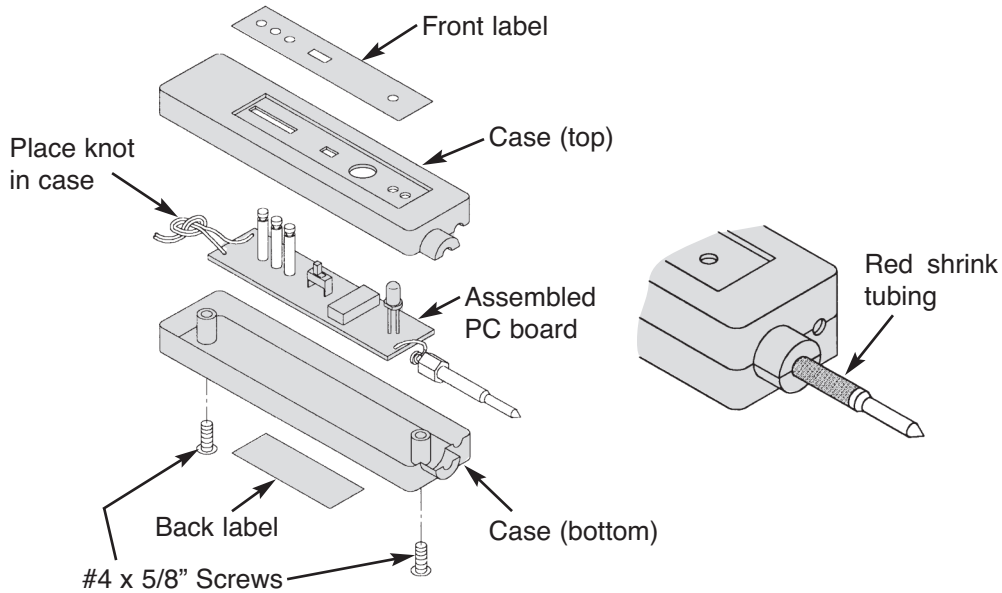


Figure 11

TESTING YOUR LOGIC PULSER

Checking out your Logic Pulser for proper operation is fairly easy. All that is needed is a 9V battery or other DC power source (5-10V). Connect the red alligator clip to the positive terminal of the battery and the black clip to the negative terminal.

Set the pulse repetition rate switch to the 0.5PPS position. Check the red LED. It should blink once every 2 seconds (0.5PPS). Set the switch to 400PPS. The Logic Pulser generates a frequency of 400Hz. At this frequency, the LED flashes at a rate that makes it appear to be on continuously. If either of these tests fail:

a) Check the input cable. The ribbed wire with the red alligator clip should go to the hole marked (+).
b) Check for cold solder joints and solder bridges around the IC. Check that the IC notch matches the notch shown on the PC board.
c) Check the soldering and polarity of diodes D1, D2, D3 and D6 (LED).
d) Check that transistor Q5 is the correct type and is mounted with the flat side as shown on the PC board.
e) Check the soldering and the values of capacitors C1 through C5.
f) Check the soldering and the values of resistors R1 through R5 and R15 through R17.

If you have an oscilloscope, connect it to the Square (SQ) pin and observe the waveforms shown in Figure 12 for pulse repetition rate switch settings of 400PPS and 0.5PPS. The times shown are approximate. If you do not get these waveforms:

a) Check the value and soldering of R16.
b) Check that transistor Q5 is the correct type and is mounted with the flat as shown on the PC board.
c) Check the value and soldering of capacitors C3, C4 and C5.

Connect the pulser tip to the resistor combinations shown in Figure 12 and observe the waveforms shown for the pulser tip. If you do not get these waveforms:

a) Check that transistors Q1 through Q4 are the correct type and are mounted with the flat side as shown on the PC board.
b) Check the soldering and polarity of diodes D4 and D5.
c) Check the soldering and values of resistors R7 through R14.
d) Check the soldering and values of capacitors C3 through C8.

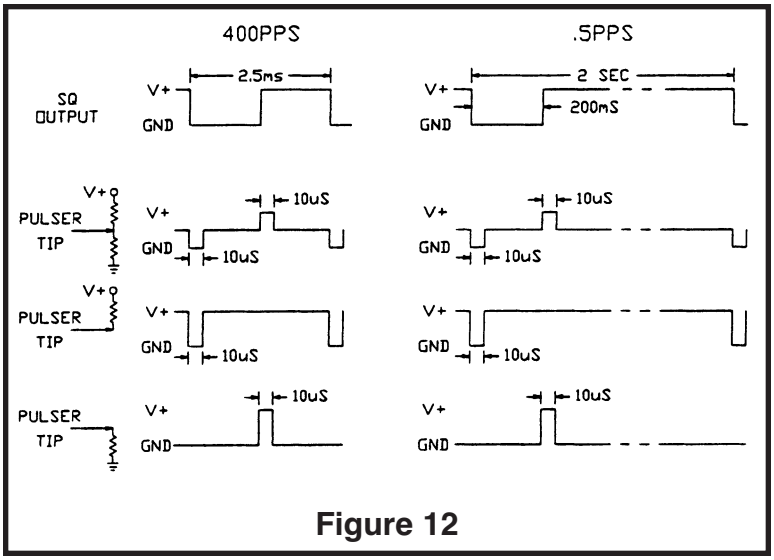
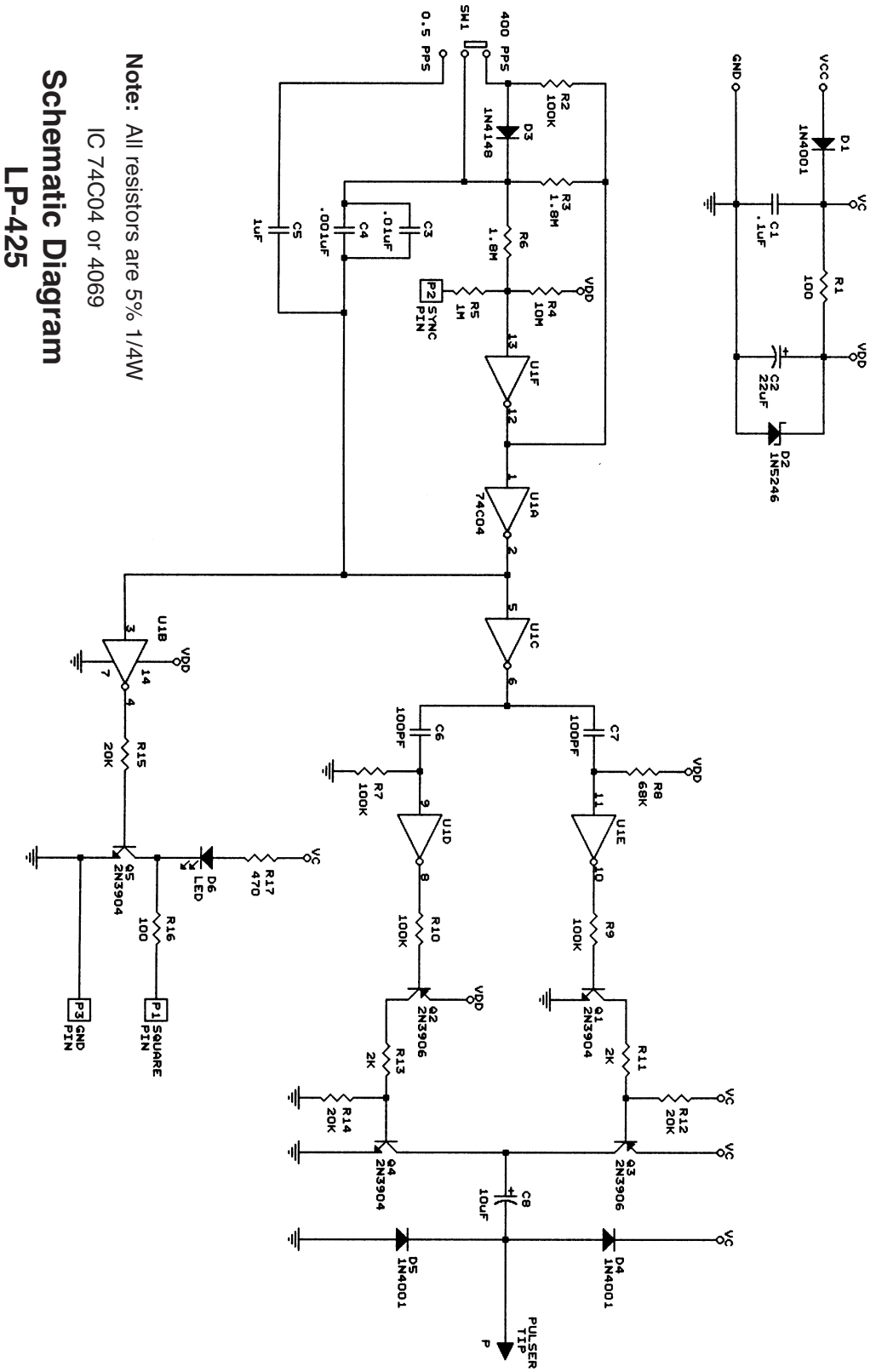


Figure 12

SCHEMATIC DIAGRAM



Note: All resistors are 5% 1/4W

IC 74C04 or 4069

Schematic Diagram
LP-425

QUIZ

1) The LP-425 Logic Pulser can produce a _____ microsecond pulse at 100mA.
   - ❒ A. 30
   - ❒ B. 15
   - ❒ C. 10
   - ❒ D. 20

2) The Logic Pulser operates by producing a large transient current for a _____ period of time.
   - ❒ A. long
   - ❒ B. short
   - ❒ C. long and short
   - ❒ D. none of the above.

3) The signal frequency of the Logic Pulser are ____ Hz and ____ Hz.
   - ❒ A. 10, 100
   - ❒ B. 0.1, 300
   - ❒ C. 0.5, 400
   - ❒ D. none of the above.

4) The Logic Pulser also has a _____ wave output terminal.
   - ❒ A. square
   - ❒ B. sine
   - ❒ C. saw
   - ❒ D. cosine

5) The operating supply voltage range is _____.
   - ❒ A. 0V to 10VDC.
   - ❒ B. 4V to 15VDC.
   - ❒ C. 20V to 45VDC.
   - ❒ D. 0.1V to 5VDC.

6) The LP-425 Logic Pulser is a very handy device for inspecting and repairing _____.
   - ❒ A. motor circuits.
   - ❒ B. logic circuits.
   - ❒ C. lighting circuits.
   - ❒ D. radar circuits.

7) The Sync input impedance of the LP-425 is _____.
   - ❒ A. 3MΩ.
   - ❒ B. 2MΩ.
   - ❒ C. 4MΩ.
   - ❒ D. 1MΩ.

8) When the switch is set to 0.5Hz, the signal on the terminal is a pulse, high for _____ of the time and ground for the remaining _____.
   - ❒ A. 50%, 50%.
   - ❒ B. 20%, 80%.
   - ❒ C. 90%, 10%.
   - ❒ D. 60%, 40%.

9) The Sync Input Terminal (SYNC) Logic Pulser can be used to produce an externally synchronized signal at the _____.
   - ❒ A. output.
   - ❒ B. input.
   - ❒ C. input and output.
   - ❒ D. none of the above.

10) The free air operating temperature range is _____.
   - ❒ A. 0 - 100°C.
   - ❒ B. 30 - 40°C.
   - ❒ C. 0 - 50°C.
   - ❒ D. 25 - 75°C.

Answers to Quiz: 1. C; 2. B; 3. C; 4. A; 5. B; 6. B; 7. D; 8. C; 9. A; 10. C

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